

REVIEW OF AUSTRALIAN ISOPODS OF THE CYMOTHOID GROUP.

Part II.⁽¹⁾

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(Contribution from the South Australian Museum.)

[Read August 12, 1926.]

PLATES XXXVI. AND XXXVII.

Family CYMOTHOIDAE.

The representatives of this family, when adult, are distinguished by the following characters:—Antennae short, not clearly divided into peduncle and flagellum. Mandibles with stout, three-jointed palp. First maxillae styloform, with a few apical spines. Apex of second maxillae bilobed. Palp of maxilliped two-jointed, the terminal article as a rule furnished with hooked spines. Pleopods, uropods, and telson rarely with any trace of marginal hairs. Peraeopods prehensile, terminating in curved (and usually strong) dactyli.

All the species are parasites, and in the adult state some are variable in form, the body being asymmetrical, twisted, or distorted. At least seven of the genera are represented off Australian coasts; the keys to the Australian genera and species refer to adult specimens.

In dealing with this family I wish to express thanks to Dr. K. H. Barnard, of the South African Museum, and to Mr. F. A. McNeill, of the Australian Museum, for assistance with literature not available in Adelaide libraries.

KEY TO AUSTRALIAN GENERA.

- a. Pleon composed of six distinct segments. Exopod of first pair of pleopods soft, not curved over sides of pleon.
- b. Cephalon not at all immersed in first peraeon segment, with posterior margin trilobate. Anterior margin of first peraeon segment trisinate.
- c. Peraeon relaxed and usually flattened; posterior angles of hinder segments often prominently produced; all coxal plates large and prominent *Nerocila*
- cc. Peraeon compact; posterior angles of hinder segments never produced; coxal plates of fourth to seventh segments small *Anilocra*
- bb. Cephalon more or less immersed in first peraeon segment, with posterior margin not trilobate. Anterior margin of first peraeon segment not trisinate.
- d. Antennae somewhat compressed, not at all dilated, the bases of the first pair widely separated.
- e. Pleon abruptly narrower than peraeon *Cymothoa*
- ee. Pleon not abruptly narrower than peraeon.
- f. Pleon rarely strongly immersed in peraeon. Carina of basos of posterior peraeopods more or less prominent. Upper lip not prominently projecting *Lixoneca*
- ff. Pleon usually strongly immersed in peraeon. Carina of basos of posterior peraeopods obsolete. Upper lip prominently projecting *Irona*
- dd. Antennae considerably dilated, the first pair contiguous at base.
- aa. Pleon segments fused together. Exopod of first pair of pleopods hard, curved over sides of pleon *Ourozeukes*

(1) Part I., Trans. Roy. Soc. S. Austr., xlix., 1925, pp. 128-185, figs. 1-28.

NEROCILA, Leach.

Nerocila, Leach, Dict. Sci. Nat., xii., 1818, p. 351; Sch. and Mein., Naturh. Tidsskr., (3) xiii., 1881, p. 4; Stebbing, S. Afr. Crust., ii., 1902, p. 55 (syn.); Rich., Bull. U.S. Nat. Mus., liv., 1905, p. 219.

Pterisopodus, Boone, Proc. U.S. Nat. Mus., liv., 1918, p. 219.

The posterior margin of the cephalon is prominently trilobate, and the anterior margin of the first peraeon segment is correspondingly trisinuate. The peraeon is depressed and somewhat relaxed and all the coxal plates are large and prominent.

It is known that in the Cymothoidae, protandrous hermaphroditism occurs in at least four genera, one of which is *Nerocila*. Calman⁽²⁾ remarks that "In certain Cymothoinae the external characters of the male sex do not completely disappear when the individual passes into the female phase, the copulatory appendage of the second pleopods sometimes remaining of conspicuous size even in specimens which have the marsupium filled with eggs." In fig. 1, *e*, *f*, and *g* are

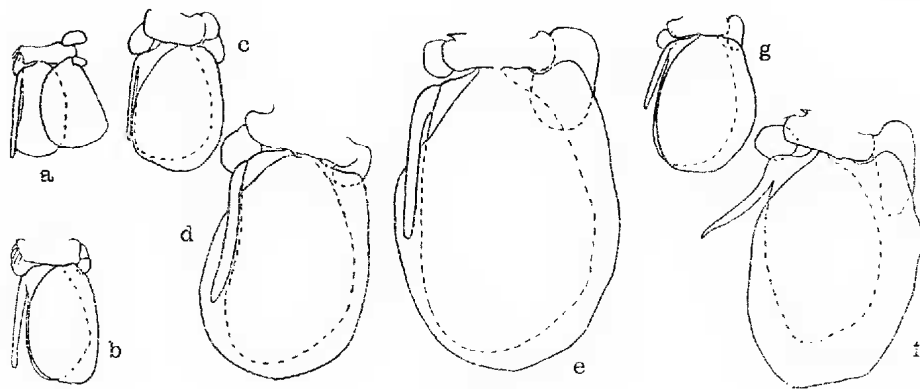


Fig. 1.

a to *e*, Second pleopods of five specimens of *Nerocila macleayii*, respectively 17 mm., 18.5 mm., 21 mm., 26 mm., and 33 mm. in length, showing diminution in relative length of male appendage as the animal grows; the pleopod at *e* is that of an ovigerous female, but the male appendage is persistent; *f* and *g*, second pleopods of ovigerous females of *N. laticauda* and *N. serra*, with male appendage (all 5 diam.).

drawings of the second pleopod of an ovigerous female of each of the species of *Nerocila* occurring in Australian waters; the examples from which the organs were taken have a well-developed brood pouch crammed with either eggs or young, but, nevertheless, the "appendix masculina" is retained. An examination of some two score specimens of *N. macleayii* and *N. laticauda* indicates that the male appendage of the second pleopods is long in the young and steadily diminishes in relative size as the animals grow, and that it is commonly retained, in a thin and abbreviated form, in the ovigerous females of these species. Thus, in a specimen of *N. macleayii* 17 mm. in length the appendage is longer than the endopod, in an example 18.5 mm. in length it is a little shorter than the endopod, and so on, until in the adult female it is not much more than one-half as long as the endopod (fig. 1, *a* to *e*).

(2) Calman, Lankester's Treatise on Zool. (Crust.), 1909, p. 213.

KEY TO AUSTRALIAN SPECIES.

- a. Coxal plates of seventh peraeon segment not reaching back beyond posterior angles of that segment. Edges of endopod of uropoda not serrate.
 - b. Uropoda not or scarcely extending beyond apex of telson, with endopod sub-oval and apically rounded *laticauda*
 - bb. Uropoda extending beyond apex of telson, with apex of endopod acute.
 - c. Postero-lateral angles of second and third peraeon segments not backwardly produced; endopod of uropoda with intero-posterior margin very obliquely truncate and sometimes slightly concave *macleayi*
 - cc. Postero-lateral angles of second and third peraeon segments backwardly produced; endopod of uropods with inner margin slightly curved and outer margin somewhat sigmoidal *australasiae*
- aa. Coxal plates of seventh segment reaching back beyond posterior angles of that segment; edges of endopod of uropoda conspicuously serrate *serra*

As will be seen from the illustrations the maxilliped is very similar in the three species examined, the organs only differing in relative width, commensurate with the form of the animal concerned; the maxillae also are apparently of little specific value.

NEROCILA LATICAUDA, Schioedte and Meinert.

Nerocila blainvilliei, Sch. and Mein., Naturh. Tidsskr., xiii., 1881, p. 78, pl. vi., figs. 11, 12 (nec M. Edwards).

Nerocila laticauda, Sch. and Mein., loc. cit., p. 81, pl. vi., figs. 14, 15; Whitel., Mem. Austr. Mus., iv., 1901, p. 235.

♀. Ovigerous. Surface smooth or almost smooth, with a very few scattered punctures. Cephalon subquadrate, a little wider than medianly long; eyes very obscure. First antennae a little shorter than second and composed of eight articles; second antennae reaching back to level of hinder margin of cephalon, composed of nine articles. First article of palp of mandibles stouter and not much longer than second, which is longer than the third article. Peraeon widest at fifth segment; medial length of first segment a little greater than that of second to fourth segments, and subequal to that of fifth to seventh segments; postero-lateral portions of all segments produced outwards and backwards, those of the last three segments very prominently produced, in the seventh segment reaching back to beyond level of hinder margin of fifth pleon segment. Coxal plates almost wholly concealed by expanded lateral parts of peraeon segments in dorsal view, only a tiny portion of the first two pairs being visible; all strongly carinate; the plates of the second segment do not nearly reach to the postero-lateral angles of the segment and the next pair reach to the middle of the length of the lateral margin of their segment; those of the fourth segment scarcely extend beyond level of posterior angle of the third segment, those of the fifth and sixth reach a little beyond level of the posterior angles of the fourth and fifth segments, while those of the seventh segment do not attain the level of the posterior angles of the sixth segment. First five segments of pleon subequal in length and width, medianly tumid, and with pleural portions somewhat produced; telsonic segment subquadrate, about one-third wider than medianly long. Uropods not quite reaching to hinder margin of telson; with both rami suboval, the exopod longer and wider than the endopod. Peracopods stout and strong, slightly increasing in length backwards.

Colour during life: Dorsum dark olivaceous, with lateral portions of head, a diffused stripe on each side of mid-line of peraeon and pleon, and lateral margins of peraeon and pleon, whitish. Underside whitish, with the outer face of each coxal plate and the outer half of the exopod of the first pair of pleopods, sooty.

Length, 32 mm.

Loc.—South Australia: Kingston, S.E. Coast, and Port Willunga, from *Raja australis* (S. Austr. Mus. Coll.). Western Australia: Albany (W. Austr. Mus. Coll.). Victoria: Port Phillip (J. B. Wilson). New South Wales: Off Botany Bay, 50-52 faths.; off Wata Mooli, 70-78 faths.; off Cape Three Points, 41-50 faths.; and off Jibbon, 50-66 faths. ("Thetis" Exped.), La Perouse, Botany Bay (J. D. Ogilby), Port Jackson (Austr. Mus. Coll.).

Hab.—Western, Southern, and Eastern Australia.

There is considerable variation in the series of adult specimens of this species which is before me. In the example shown at *a* in fig. 2 (a male 23 mm. in length), the lateral parts of the last three peraeon segments are more expanded and backwardly produced, and the pleural parts of the first five pleon segments are much more prominent than in the female at *i*. The peraeon segments are not at all expanded in very young articles, and, generally, the form of small

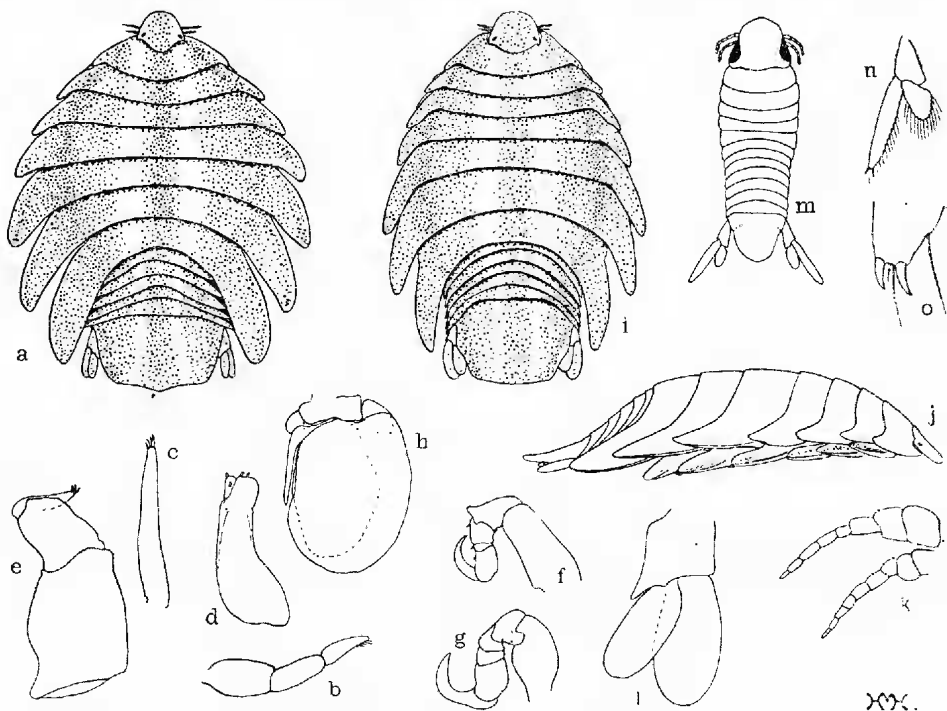


Fig. 2.

Nerocila laticauda. Adult male phase: *a*, dorsal view (21 diam.); *b*, palp of mandible (19 diam.); *c* and *d*, first and second maxillae (19 diam.); *e*, maxilliped (19 diam.); *f* and *g*, first and seventh peraeopods (5 diam.); *h*, second pleopod (4 diam.). Ovigerous female: *i* and *j*, dorsal and lateral views (1½ diam.); *k*, antennae (6 diam.); *l*, uropod (5 diam.). Juvenile from marsupium: *m*, dorsal view (11 diam.); *n*, uropod (19 diam.); *o*, apex of exopod of uropod (95 diam.).

specimens is narrower than in the adult. The extent to which the segments are produced is, however, by no means constant, and a few small specimens have the lateral parts of the peraeon segments much more expanded than in some of the large ovigerous females. In the last-named the sides of the segments are occasionally scarcely at all expanded (so that all the coxal plates are visible in dorsal view) and the postero-lateral angles of only the sixth and seventh segments are backwardly produced (fig. 3, *c*). Intermediate forms between this and the greatly widened variety occur in other of the adults. The telsonic segment is somewhat

variable in shape, and may be subquadrate or even obscurely subcordate; the posterior margin is usually gently convex or sinuate, but is occasionally concave.

The salient features of the adult are as follows: The lateral parts of the last peraeon segment are always more or less widely expanded, and are produced backwards to at least the level of the posterior angles of the third pleon segment—usually they extend further back than this; the lateral parts of the other segments are generally more or less expanded and produced backwards. The apex of each of the last pair of coxal plates, at most, scarcely reaches past the middle of the length of the lateral margin of the seventh segment. The branches of the uropoda are, as a rule, both suboval (sometimes the exopod is acutely rounded apically), and do not reach much beyond the posterior margin of the telson.

In young examples taken from the marsupium of the mother the cephalon is relatively much larger than in the adult, and the eyes are large. None of the segments of the peraeon or pleon is backwardly produced or laterally expanded. The uropods are of interest in that they differ somewhat considerably from those of the adult. The suboval endopod is scarcely one-half as long, and is one-half as wide again, as the lanceolate exopod; the posterior half of the margins of the endopod, and the inner margin of the exopod, are furnished with hairs, and

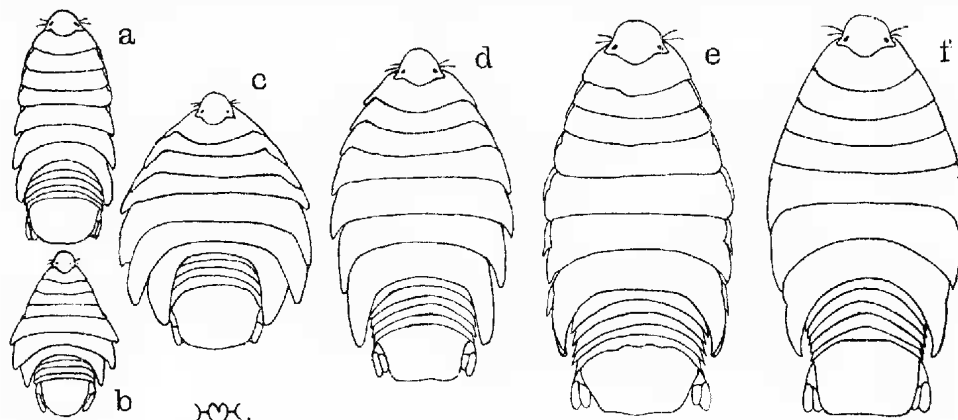


Fig. 3.

Variation in form of *Nerocila laticauda*: d, e, and f are outlines of ovigerous females (all 2 diam.).

the apex of the exopod bears two strong spines. The colour is whitish with the whole dorsum, excepting the telson, dotted with brown chromatophores, which are larger on the cephalon than on the peraeon or pleon. The example figured at m, fig. 2, is 3.14 mm. in length, and was taken from the pouch of a female of the form shown at i.

Examples only 10 mm. or so in length have the characteristic colour markings as described for the adult, the dark parts consisting of a great number of closely massed chromatophores. In specimens of this size the eyes are tiny, the exopod of the uropods is subacute apically, is much longer than the endopod, and reaches beyond the level of the obtusely angular apex of the telson.

The specimens referred to "*Nerocila blainvillei*" by Schioedte and Meinert were taken "ad Adelaide, Novae-Hollandiae," but, as shown above, the two forms considered by these authors to be distinct species are connected by intermediate varieties. Milne Edwards' description indicates that *N. blainvillei* is an entirely different species, for this author remarks⁽³⁾: "Espèce très-voisine de la

(3) M. Edw., Hist. Nat. Crust., iii., 1840, p. 252.

précédente, [*N. bivittata*] mais ayant les angles du tergum des anneaux plus pointus, les épimères plus allongés (*les deux dernières paires dépassant de beaucoup les angles du tergum correspondans*). . . . Patrie inconnue."

In *N. laticauda* the posterior coxal plates do not nearly reach to the posterior angle of their segment. The coxal plates of *N. bivittata*, as shown in the figures of Schioedte and Meinert⁽⁴⁾ are much longer than those of the specimen figured by the same authors as *N. blainvilliei*.

NEROCILA MACLEAYII, White.

Nerocila macleayii, White, in Dieffenb. Voy. N. Zeal., ii., 1843, p. 268; Miers, Rep. Zool., "Alert," 1884, p. 301; Chilton, Trans. N. Z'd. Inst., xxiii., 1891, p. 68, pl. xi.

Nerocila imbricata, Miers, Cat. Crust. N. Z'd., 1876, p. 107.

Nerocila novae-zealandiae, Sch. and Mein., Naturh. Tidsskr., (3) xiii., 1881, p. 70, pl. v., figs. 10, 11.

♀. Oviparous. Surface glabrous, with a very few scattered punctures. Cephalon rounded, with posterior margin very distinctly trilobate; much wider

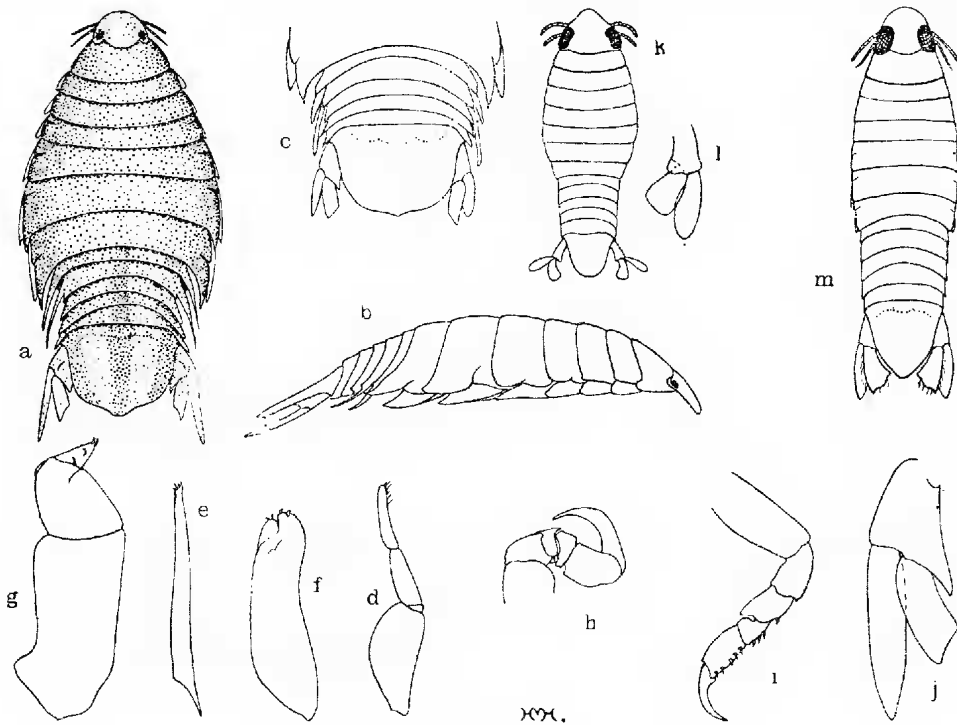


Fig. 4.

Nerocila macleayii. Oviparous female: *a* and *b*, dorsal and lateral views (1½ diam.); *c*, pleon of another example (1½ diam.); *d*, palp of mandible (19 diam.); *e* and *f*, first and second maxillae (19 diam.); *g*, maxilliped (19 diam.); *h* and *i*, first and seventh pereopods (5 diam.); *j*, uropod (5 diam.). Juvenile from marsupium: *k*, dorsal view (10 diam.); *l*, uropod (29 diam.). *m*, Immature example, 17 mm. in length (3 diam.).

than medianly long; eyes small but distinct. First antennae stouter and a little shorter than second, composed of six articles; second antennae reaching back to middle of length of first pereon segment and composed of eight articles. First article of palp of mandibles stouter and more than half as long again as

(4) Sch. and Mein., Naturh. Tidsskr., (3) xiii., 1881, pl. iv., figs. 1-15.

second, which is scarcely longer than the third article. Peraeon widest at fifth and sixth segments; medial length of first segment distinctly greater than that of second, third, or fourth segment and subequal to that of fifth, sixth, or seventh segment; postero-lateral parts of sixth and seventh segments backwardly produced in a narrow process with acute posterior angles; posterior angle of first segment very slightly produced backwards. All coxal plates more or less visible in dorsal view; last three pairs obtusely carinate and with posterior angles acute; plates of second to fifth segments reaching to or a little beyond posterior angle of their segments, those of sixth and seventh segments not nearly attaining level of posterior angles of their segments. First five segments of pleon subequal in length; pleural portions of first and second segments produced into narrow, flat processes, those of the second segment reaching back to level of posterior angles of fifth segment; telsonic segment subcordate, wider than long. Endopod of uropods reaching slightly beyond level of apex of telson, wider and much shorter than the exopod, with lateral margins subparallel and with inner posterior margin very obliquely truncate, so that the apex of the ramus is acute. Peraeopods moderately stout, successively increasing in length; seventh pair with one spine on inner margin of merus, three on inner margin of carpus, and four or five on inner margin of propodus.

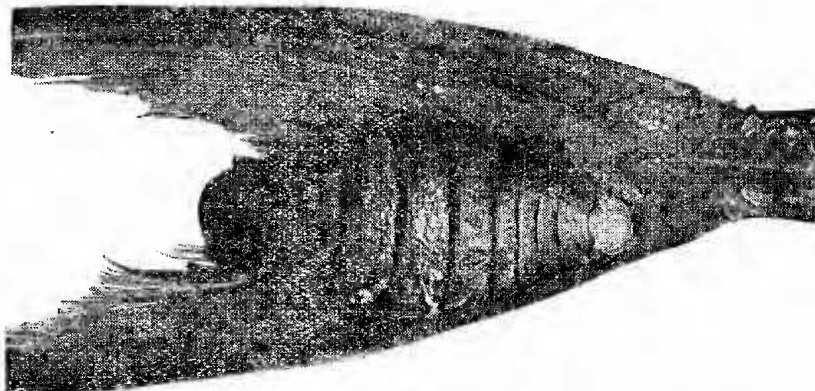


Fig. 5.

Nerocila macleayi clinging to tail of *Temnodon saltator* ($2\frac{1}{2}$ diam.).

Colour in alcohol: Dark olivaceous, sometimes with segments margined with paler colour, sometimes with a pale stripe on each side of mid-line of pleon; in some cases the stripes meet, thus forming a U-shaped marking on the telson.

Length, 32 mm.

Loc.—New South Wales: Port Jackson and from *Mola mola* (Austr. Mus. Coll.), Port Hacking (D. G. Stead), Shoalhaven (C. Hedley), Eden, from fin of flying gurnard (A. Cameron). Victoria: Warrnambool, from fins of *Chimaera* (J. L. Fenton). Western Australia: Nornalup Inlet, on tail of *Temnodon saltator*; Fremantle, Bunbury, and Albany (W. Austr. Mus. Coll.). No definite loc., from *Sardinia neopilchardus* (J. D. Ogilby).

Hab.—Australia and New Zealand.

According to the series before me there is not such variation in the fully developed female of this species as in *N. laticauda*. Two ovigerous females, however, taken from a pilchard, are but 21 mm. in length, are narrow in form, and have the postero-lateral angles of the sixth and seventh peraeon segments scarcely at all produced backwards (so that the last coxal plates attain the level of the posterior angles of their segment), and the pleural processes of the first

and second pleon segments are little developed; these two specimens resemble very closely an immature example figured by Chilton.⁽⁵⁾ Other large examples, which are still in the male phase, have the posterior peraeon and anterior pleon segments produced as in the large ovigerous females. Some of the last-named are a little wider in form than the example shown in fig. 4, and others have the postero-lateral angles of the fifth peraeon segment a little backwardly produced, so that the coxal plates of this segment also do not reach to the level of the posterior angles. As in *N. laticauda*, the relative lengths of the branches of the uropods are somewhat variable.

The salient features of the adults of the species are as follows:—The postero-lateral angles of the second and third peraeon segments are never backwardly produced. The coxal plates of the seventh segment do not extend to the level of the posterior angles of that segment, except in small specimens in which the posterior angles of the segments are scarcely at all produced. The uropoda reach beyond the apex of the telson; the endopod is very obliquely truncate, with the apex acute, while the exopod is narrower and usually much longer than the endopod. The pleural processes of the first and second pleon segments reach to at least the level of the hinder margin of the fifth pleon segment in large examples; sometimes they are even longer.

N. californica, Schioedte and Meinert, appears to be closely related to *N. macleayi*.

The immature example figured by Chilton (*ut supra*) is approximately 20 mm. in length; a slightly younger form, 17 mm. in length, is here shown in fig. 4, *m*. In this specimen the antennae reach back to the posterior margin of the first peraeon segment, the uropods are much as in the "virgo" figured by Schioedte and Meinert, and the eyes are still large and prominent; in examples 20 mm. or more in length the eyes are much smaller and contain fewer facets. As previously noted, the eyes have degenerated in specimens of *N. laticauda* only 10 mm. in length. A young example of *N. macleayi*, 3.45 mm. in length, taken from the marsupium of the mother, is illustrated at *k*, fig. 4; the endopod of the uropods is wider and shorter than the exopod, and is somewhat roundly subtruncate posteriorly.

NEROCILA AUSTRALASIAE, Schioedte and Meinert.

Nerocila australasiae, Sch. and Mein., Naturh. Tidsskr., (3) xiii., 1881, p. 35, pl. vi., figs. 7, 8.

I have seen no specimens agreeing with the description of this species, which is evidently very closely allied to *N. macleayi*. According to the authors' figures of their single specimen, the posterior angles of all the peraeon segments are more or less produced backwards (although the angles of the second segment are apparently not at all prominent) and the endopod of the uropods is of different shape.

Length, 29 mm.

Hab.—Tasmania: "Hobarttown."

NEROCILA SERRA, Schioedte and Meinert.

Nerocila serra, Sch. and Mein., Naturh. Tidsskr., (3) xiii., 1881, p. 17, pl. i., figs. 12-14; Nierstrasz, Zool. Medel. i., 1915, p. 74; Barnard, Ann. S. Afr. Mus., xx., 1925, p. 392.

♀. Ovigerous. About twice as long as wide. Surface glabrous, with tiny and rather sparse punctures. Cephalon wider than medianly long, with anterior margin rounded and somewhat angular in the middle; posterior margin very distinctly trilobate; eyes small but distinct. First antennae a little shorter and stouter than second, composed of eight articles; second antennae not reaching to middle of length of first peraeon segment, composed of nine articles. First

(5) Chilton, Trans. N. Z'd. Inst., xxiii., 1891, pl. xi., fig. 2.

article of palp of mandibles stouter and a little longer than second, which is distinctly longer than third. Peraeon widest at fifth segment; medial length of first segment a little greater than that of second to fourth segments, and subequal in length to fifth to seventh segments. Postero-lateral portions of all segments produced backwards and a little outwards, with the posterior angles acute; posterior angles of seventh segment reaching back almost to level of posterior angles of third pleon segment. Coxal plates well developed, falcate, all visible in dorsal view, the hinder pairs prominent; plates of second to fifth segments not or scarcely reaching beyond the posterior angles of their segments; those of sixth and seventh segments distinctly longer than their segments, the acute apices of the seventh plates reaching almost to level of posterior angles of fifth pleon segment. First five pleon segments subequal in length; pleural parts of first and

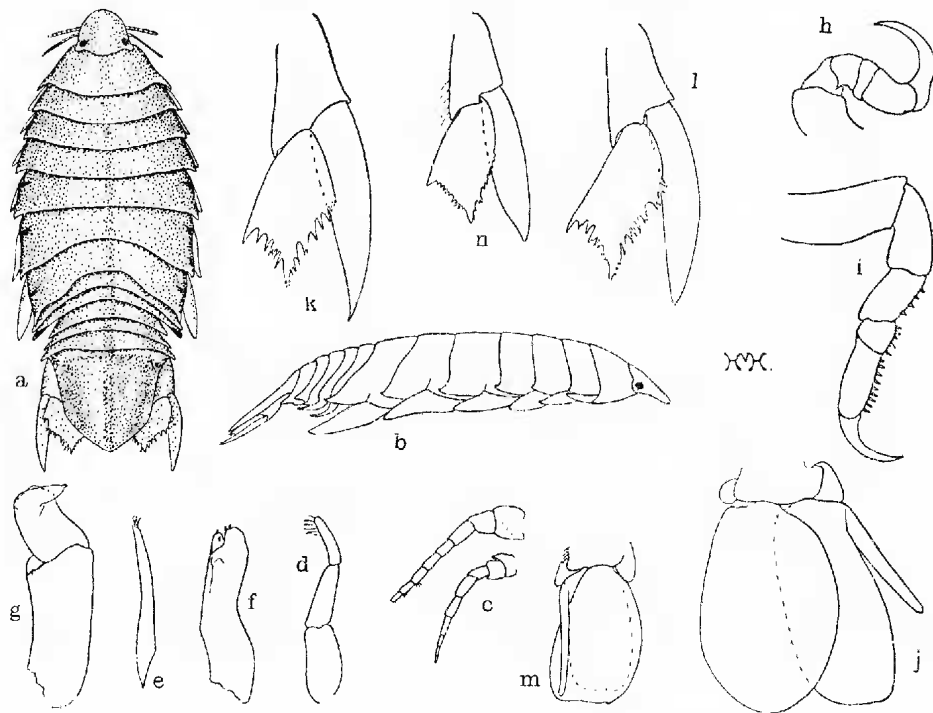


Fig. 6.

Nerocila serra. Adult male phase: *a* and *b*, dorsal and lateral views (2½ diam.); *c*, antennae (6 diam.); *d*, palp of mandible (19 diam.); *e* and *f*, first and second maxillae (19 diam.); *g*, maxilliped (19 diam.); *h* and *i*, first and seventh peracopods (6 diam.); *j*, second pleopod (6 diam.); *k*, uropod (6 diam.). *l*, Uropod of ovigerous female (6 diam.). *m* and *n*, Second pleopod and uropod of immature example (6 diam.).

second segments produced, narrow and apically acute, those of the second segment reaching back to posterior angles of fifth segment; telsonic segment subcordate, with an obsolete median carina; basal width equal to medial length; postero-lateral margins very finely serrate. Endopod of uropods reaching beyond apex of telson, shorter and wider than exopod, with inner margin, and proximal part of outer margin, slightly convex, and with inner and outer posterior margins coarsely and conspicuously serrate; exopod falcate. Peraeopods moderately stout, successively increasing in length; seventh pair with five stout spines (two of which are shorter than the others) on inner margin of merus, five spines on inner margin of carpus, and eight or nine on inner margin of propodus.

Colour in alcohol: Dorsum yellowish with a blackish median stripe for whole length of animal, and with a blackish stripe on each side of peraeon and first five segments of pleon. Underside and peraeopods pale.

Length, 20 mm.

Loc.—Queensland: Great Palm Island, from *Lutianus* sp. (Dr. W. E. J. Paradise), Brisbane (J. D. Ogilby), Cairns (A. M. Lea).

Hab.—Malay Archipelago, South Africa (Barnard), and Queensland.

The marsupium of the female described above is filled with ova. As the ovigerous female is illustrated by Schioedte and Meinert, I have here figured an example, 22 mm. in length, in the adult male phase. This specimen differs from the ovigerous female in being of narrower form, in not having the posterior angles of the peraeon segments so much backwardly produced, and in having the last pair of coxal plates shorter, but nevertheless reaching beyond the posterior angles of the seventh peraeon segment. The pleural portions of the first and second pleon segments are not so greatly produced and the general colouration of the dorsum is darker, so that the median and lateral stripes are not prominent.

An immature specimen 16.5 mm. in length is still more slender in form, the eyes are degenerate (but are larger than in adult examples), the antennae reach back almost to the hinder margin of the first peraeon segment, and the posterior angles of only the first, sixth, and seventh peraeon segments are backwardly produced, and these but slightly; the coxal plates are less developed, but the last pair reach beyond the posterior angles of their segment. The right uropod is abnormal, but the left is much as in the adult, excepting that the serrations, while distinct, are not nearly as conspicuous (fig. 6, *n*). As in *N. laticauda* and *N. macleayii*, the male appendage of the second pleopods is relatively longer in the young than in large specimens (fig. 6, *j* and *m*). The postero-lateral borders of the telson are minutely serrate in all examples examined.

The type female figured by Schioedte and Meinert (22 mm. in length) apparently has the endopod of the uropods relatively narrower than in the Queensland specimens.

ANILOCRA, Leach.

Anilocra, Leach, Dict. Sci. Nat., xii., 1818, pp. 348, 350; Sch. and Mein., Naturh. Tidsskr., (3) xiii., 1881, p. 100; Stebb., Herdman's Pearl Fish., Ceylon, Suppl. Rep., xxiii., 1905, p. 25 (syn.); Rich., Bull. U.S. Nat. Mus., liv., 1905, p. 226.

The posterior margin of the cephalon is trilobate, but not prominently so. The posterior angles of the second to sixth peraeon segments are never produced (but are often produced in the preceding genus). The peraeon is rather thick and compact, the coxal plates of the fourth to seventh segments are somewhat small and do not nearly reach to the posterior angles of their segments.

ANILOCRA CAVICAUDA, Richardson.

Anilocra cavicauda, Rich., Wash. Bur. Fish., Doc. 736, 1910, p. 18, fig. 17.

♀. Ovigerous. Surface smooth, with a few scattered punctures. Cephalon much wider than medianly long, narrowed in front of eyes and with anterior margin roundly subtruncate and downbent. Eyes rather large, oval, composite; widely separated and situate at postero-lateral portions of cephalon. First antennae stouter than, and about two-thirds as long as, second antennae; composed of eight articles and slightly geniculate at articulation of third and fourth articles. Second antennae reaching back to hinder margin of first peraeon segment and composed of ten articles. Peraeon widest at fifth segment; first segment longer than second or third, but shorter than any of the other segments; second to fifth segments successively increasing in length, the sixth being more than three times as long as the second segment; seventh segment subequal in length to fourth. None of coxal plates carinate; those of second and third seg-

ments subquadrate in shape, reaching to level of posterior angles of their segments; those of fourth to seventh segments curved, narrower than first two pairs and with their posterior apices far removed from the hinder angles of their respective segments. Sides of pleon converging from first to fifth segments, which are subequal in length; fifth segment scarcely more than two-thirds as wide as first segment; surface of sides of third to fifth segments concave; postero-lateral margins of fifth segment concavely incised; telsonic segment not much longer than wide, with an obsolete, longitudinal, median carina; lateral margins rounded and postero-lateral margins almost straight, abruptly converging to the narrowly subtruncate apex; basal portion tumid and sides upturned, so that the dorsum of the telson is scoop-shaped. Uropods reaching to level of apex of telson; endopod suboval, subequal in length to, but wider than, exopod, which has the inner margin almost straight and the outer margin curved. Peraeopods successively increasing in length, with dactyli of first four pairs slightly swollen in the middle of their length; seventh pair with minute spinules on inner margin of some of the joints.

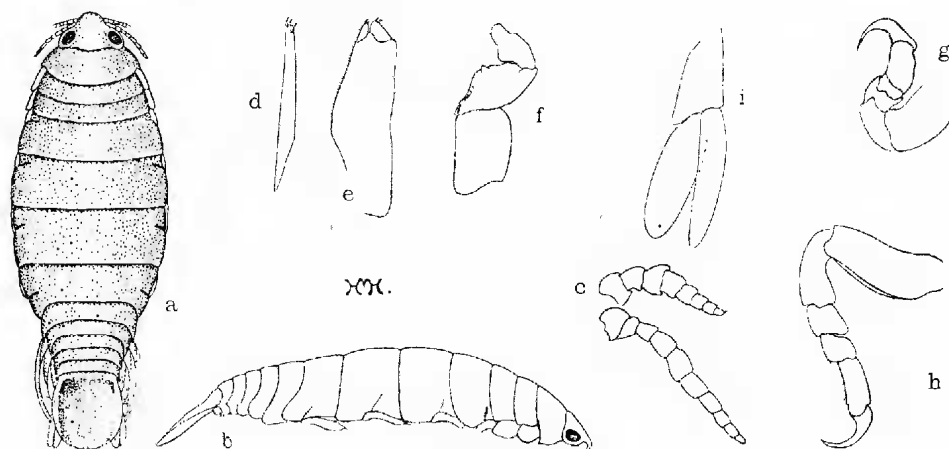


Fig. 7.

Anilocra cavicauda. Ovigerous female: *a* and *b*, dorsal and lateral views (2½ diam.); *c*, antennae (6 diam.); *d* and *e*, first and second maxillae (19 diam.); *f*, maxilliped (19 diam.); *g* and *h*, first and seventh peraeopods (6 diam.); *i*, uropod (6 diam.).

Colour in alcohol: Dorsum yellow, thickly dotted with brown chromatophores, so that the animal appears of an olivaceous colour.

Length, 26 mm.

Loc.—Queensland: Port Denison (E. H. Rainford).

Hab.—Philippine Islands and Queensland.

Two ovigerous females were collected by Mr. Rainford, who is responsible for the following interesting observation concerning the habit of this species:—"Found attacking side of occiput of rainbow fish (*Pentapus setosus*). Attached by the mouth, the parasites infest about 75 per cent. of this species of fish, always in the same position." As *A. cavicauda* was previously known from a single female, it is unfortunate that a larger series of specimens was not taken.

The second female before me is 21.5 mm. in length; in this the telson is more elongate than in the example described above, and has the postero-lateral margins slightly sinuate. In both specimens the lateral parts of the rami of the first three pairs of pleopods project beyond the sides of the rather narrow pleon; chromatophores are present on the edges of the projecting portions of the pleopods.

Richardson's type is of larger size and narrower form (36 mm. in length and 10 mm. in width), and has the telsonic segment much more elongate (9 mm. in length and 5 mm. in width) than in the Australian specimens. In these last the exopod of the uropods is very slightly longer than the endopod (a reverse condition to that obtaining in the type) and the antennae are, apparently, less markedly geniculate. Richardson says that the daetyli of the first four pairs of peraeopods are "inflated in the centre," but in the specimens now described this inflation is very slight. The salient feature of *A. cavicauda* is the concave dorsum of the telson.

A. cavicauda is widely separated from the New Caledonian species, *A. australis*, Schioedte and Meinert.⁽⁶⁾ In the last-named the exopod of the uropods is much longer than the endopod, while the Danish authors place it in a section of their key including forms which have the antennae straight and the coxal plates of the fourth to seventh segments carinate.

CYMOTHOA, Fabricius.

Cymothoa, Fabr., Entomol. Syst., ii., 1793, p. 503; Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, p. 223; Rich., Bull. U.S. Nat. Mus., liv., 1905, p. 247.

The cephalon is more or less immersed, but the hinder margin is not trilobate; the first pair of antennae are widely separated basally, and are not expanded. The first peraeon segment has the anterior margin slightly concave or sinuate and the antero-lateral angles more or less prominently forwardly produced. The coxal plates are rather thick and prominent. The pleon is abruptly narrower than the peraeon and is deeply immersed. The basos of the posterior peraeopods is expanded.

KEY TO AUSTRALIAN SPECIES.

- a. Antero-lateral angles of first peraeon segment not reaching to, or scarcely passing, level of middle of cephalon.
 - b. Anterior margin of cephalon rounded *indica*
 - bb. Anterior margin of cephalon widely truncate *limbata*
- aa. Antero-lateral angles of first peraeon segment reaching to level of four-fifths of length of cephalon *vicina*

CYMOTHOA INDICA, Schioedte and Meinert.

Cymothoa indica, Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, p. 250, pl. viii., figs. 1-4.

♀. Oviparous. Form subovate, a little more than twice as long as greatest width. Cephalon subtriangular, about one-third wider than medianly long, with apex very narrowly subtruncate. Eyes obscure. First pair of antennae stouter than and subequal in length to second; composed of eight articles; second antennae reaching to hinder angles of cephalon, composed of nine articles. Second article of palp of mandibles a little more than twice as long as third. Peraeon widest at fourth and fifth segments, first segment much longer than any of the others, its medial length nearly equal to that of the last three segments together; antero-lateral angles not reaching forward to middle of length of cephalon; anterior margin concave, towards the sides a little sinuate, and posterior margin widely sinuate; second, third, and fourth segments subequal in length; fifth shorter than fourth and longer than sixth or seventh segment; posterior angles of all segments rounded and slightly produced outwards and downwards. Coxal plates with posterior margins nearly straight or slightly incised, not reaching quite to the posterior angles of their respective segments. First three segments of pleon subequal in length and width; fourth segment a little wider but no longer than third, and fifth wider, and longer than fourth; telsonic segment twice as wide as long, wider than fifth pleon segment; postero-lateral angles rounded and posterior margin sinuate; disc with a

(6) Sch. and Mein., Naturh. Tidsskr., (3) xiii., 1881, p. 120, pl. viii., fig. 11.

median longitudinal sulcus. Uropods reaching almost to level of hinder margin of telson; rami subequal in length, narrow, curved, and apically rounded. Peraeopods strong, successively increasing in length; carina of last four pairs pronounced, the basos of the seventh peraeopods being only about one-third longer than wide.

Colour in alcohol: Brown, becoming paler posteriorly.

Length, 29 mm.

Loc.—Western Australia: Bernier Island (W. Austr. Mus. Coll.). North-western Australia (Capt. Walcott). Queensland: N.W. Islet, Capricorn Group, "from pectoral fin of *Mugil*" (G. P. Whitley); Port Denison, Bowen, "from mouth of whiting" (E. H. Rainford).

Hab.—India, North-western and North-eastern Australia.

I am greatly indebted to Mr. E. H. Rainford for a fine series of specimens from Queensland.

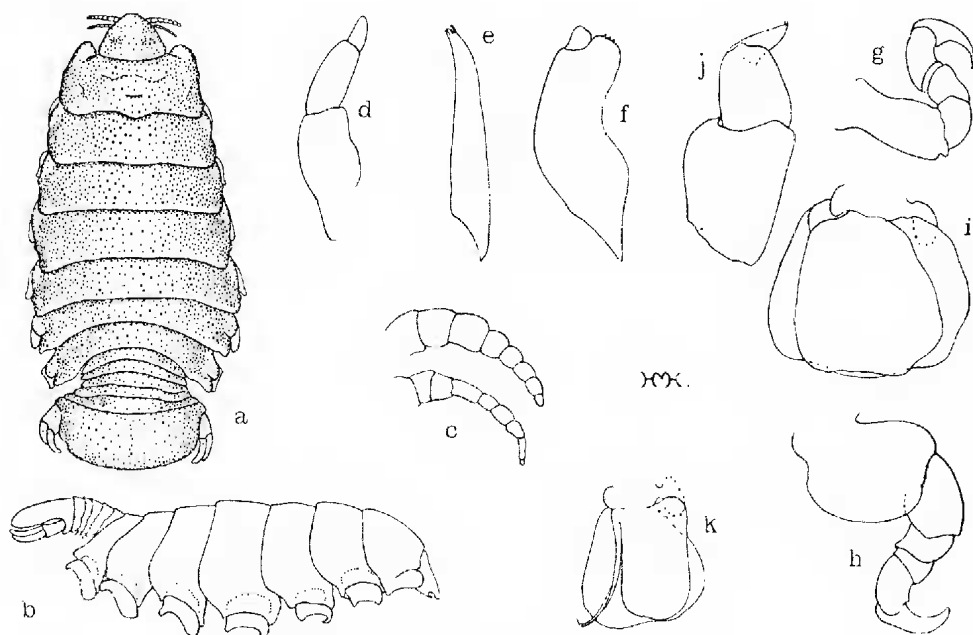


Fig. 8.

Cymothoa indica. Ovigerous female: *a* and *b*, dorsal and lateral views (1½ diam.); *c*, antennae (9 diam.); *d*, palp of mandible (29 diam.); *e* and *f*, first and second maxillae (20 diam.); *g* and *h*, first and seventh peraeopods (4 diam.); *i*, first pleopod (4 diam.). Adult male phase: *j*, maxilliped (29 diam.); *k*, second pleopod (4 diam.).

An example 20 mm. in length, in the adult male phase, has the cephalon almost as long as its basal width, the greater part of the first pleon segment hidden beneath the last peraeon segment, and the telsonic segment relatively longer than in the ovigerous female; also the coxal plates are a little longer, those of the second, third, and fourth peraeon segments reaching quite to the posterior angles of these segments. The male appendage is long and tapering, and exceeds the rami of the second pleopods in length. Schioedte and Meinert examined two specimens, an ovigerous female 20 mm. in length and one "mas adultus" only 9 mm. in length. A small male (10 mm. in length) from Queensland is very like the last-named example.

CYMOTHOA LIMBATA, Schioedte and Meinert.

Cymothoa limbata, Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, p. 250, pl. vii., figs. 1, 2.

C. limbata and *C. indica* are both included by the Danish authors in Section ii. of their "Conspectus systematicus specierum";⁽⁷⁾ this section contains forms which have the antero-lateral angles of the first peraeon segment nearly reaching or slightly passing the level of the middle of the length of the cephalon. *C. limbata* differs from *C. indica* in that the anterior margin of the cephalon is truncate. The telsonic segment is distinctly longer than the remaining segments of the pleon together. I have not seen this species, which is described from a single "virgo."

Length, 17 mm.

Hab.—Queensland: Cape York.

***Cymothoa vicina*, n. sp.**

♀. Ovigerous. Form suboval, a little more than twice as long as greatest width. Cephalon subtriangular, nearly half as wide again as medially long; anteriorly with a short, longitudinal, median sulcus; with lateral margins slightly sinuate and anterior margin very narrowly subtruncate. Eyes distinct, rather

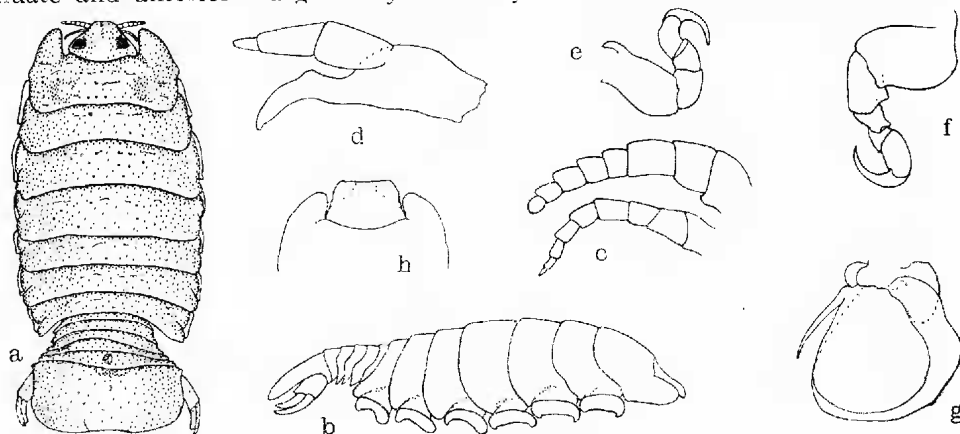


Fig. 9.

Cymothoa vicina, type ovigerous female: *a* and *b*, dorsal and lateral views (2½ diam.); *c*, antennae (9 diam.); *d*, mandible (20 diam.); *e* and *f*, first and seventh peraeopods (5 diam.); *g*, second pleopod (5 diam.). *h*, Cephalon and first peraeon segment of ovigerous female of *C. stromalei* (2 diam.).

small. First pair of antennae stouter than and subequal in length to second pair; composed of eight articles; second antennae reaching to hinder angles of cephalon, composed of nine articles. Second article of palp of mandibles scarcely more than twice as long as the third. Peraeon widest at third and fourth segments; first segment longer than any of the others, its medial length equal to that of the fifth and sixth segments together; antero-lateral angles reaching to level of four-fifths of length of cephalon; anterior margin sinuate and posterior margin very slightly sinuate; second, third, and fourth segments successively increasing slightly in length; fifth abruptly shorter, equal in length to sixth; seventh segment shortest; posterior angles of all segments obtusely rounded, scarcely at all produced. Coxal plates with posterior margins rounded, not reaching to level of hinder angles of their respective segments. First four segments of pleon subequal in length and width; fifth longer and wider; telsonic segment twice as wide as long, a little wider than fifth segment, with postero-lateral and hinder margins

(7) Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, pp. 225, 226.

rounded. Uropods reaching to level of apex of telson, with both branches curved and narrowly rounded apically; exopod longer and a little wider than endopod. Peraeopods strong, successively increasing in length backwards; carina of last four pairs moderately produced, the basos of the seventh peraeopods being half as long again as wide.

Colour in alcohol: Dark yellow.

Length, 19 mm.

Loc.—New South Wales: Tweed River, from a mullet (Franks). Type in Australian Museum, Reg. No. P8590.

The male appendage of the second pleopods is retained in the single ovigerous female before me (fig. 9, *g*). This species belongs to Section iii. of the key given by Schioedte and Meinert (*C. stromatei*, *C. oestrum*, etc.), but differs from the species placed there by these authors in not having the anterior margin of the cephalon broadly truncate or concave. In the accompanying figure the cephalon of a specimen of *C. stromatei* from New Guinea is shown for comparison.

LIVONECA, Leach.

Livoneca, Leach, Dict. Sci. Nat., xii., 1818, p. 551; Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, p. 340; Barn., Ann. S. Afr. Mus., xvii., 1920, p. 357 (syn.).

Cephalon more or less immersed. First pair of antennae not expanded but rather compressed; widely separated at the base. First peraeon segment abruptly longer than second (in which case the seventh segment is abruptly shorter than sixth) or subequal in length to other segments. Coxal plates rarely wide. Peraeopods subequal in length or successively increasing slightly in length backwards; carina of basos of last four pairs more or less prominent. Pleon rarely strongly immersed in peraeon.

KEY TO AUSTRALIAN SPECIES.

- | | |
|---|------------------|
| a. Front of cephalon not widely subtruncate; second antennae much longer than first | <i>raynaudii</i> |
| aa. Front of cephalon widely subtruncate; second antennae not longer than first | <i>turgidula</i> |

LIVONECA RAYNAUDII, Milne Edwards.

Livoneca raynaudii, M. Edw., Hist. Nat. Crust., iii., 1840, p. 262; Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, p. 367, pl. xv., figs. 9-13; Whitelegge, Mem. Austr. Mus., iv., 1901, p. 236; Stebb., Ann. S. Afr. Mus., vi., 1910, p. 425; Thielemann, München Abh. Akad. Wiss., ii., Suppl. 3, 1911, p. 42; Barn., Ann. S. Afr. Mus., xvii., 1920, p. 358; Chilton, Rec. Cant. Mus., i., 1911, p. 309, and Trans. N. Z'd. Inst., xlv., 1912, p. 135.

Livoneca novae-zealandiae, Miers, Ann. Mag. Nat. Hist., (4) xvii., 1876, p. 228, and Cat. Crust. N. Z'd., 1876, p. 106, pl. iii., fig. 2.

Livoneca stewarti, Filhol., Mission d'Ile Campbell, iii., 1885, p. 450, pl. lv., fig. 6.

♀. Ovigerous. Form suboval, about one and three-fourths times as long as wide. Cephalon immersed in first peraeon segment, subpentagonal in shape, slightly wider than medial length; front suddenly narrowed near apex, which is rounded; dorsum shallowly excavate. Eyes rather small, suboval. First antennae composed of eight articles; second antennae one-half as long again as first, composed of twelve articles. First article of palp of mandibles a little longer than second and third together; second much longer than third article, which bears a few setae near and at apex. Peraeon moderately convex; first segment slightly longer than the others, which are subequal in length. Coxal plates of second to fifth segments subpendulous, of sixth and seventh continued almost in same plane as their segments; plates of second and third segments almost or quite reaching to postero-lateral angles of their segments, and remaining plates not attaining hinder angles of their segments. First pleon segment partly concealed beneath last peraeon segment; second to fifth segments subequal

in width, the fifth a little longer than second to fourth, which are subequal in length; telsonic segment a little less than twice as wide as medial length, with hinder margin semicircular, and with an obsolete, median earina on basal half of dorsum. Uropods not reaching much beyond level of middle of length of telsonic segment; both branches suboval and slightly tapering, the exopod a little larger than the endopod. Peraeopods rather stout, successively increasing in length backwards; basos of first three pairs with a low earina; basos of last four pairs with a carina, which is somewhat prominently produced near the proximal end. Pleopods successively decreasing in size backwards, the outer ramus of each longer and much wider than the inner.

Colour in alcohol: Yellow.

Length, 38 mm.

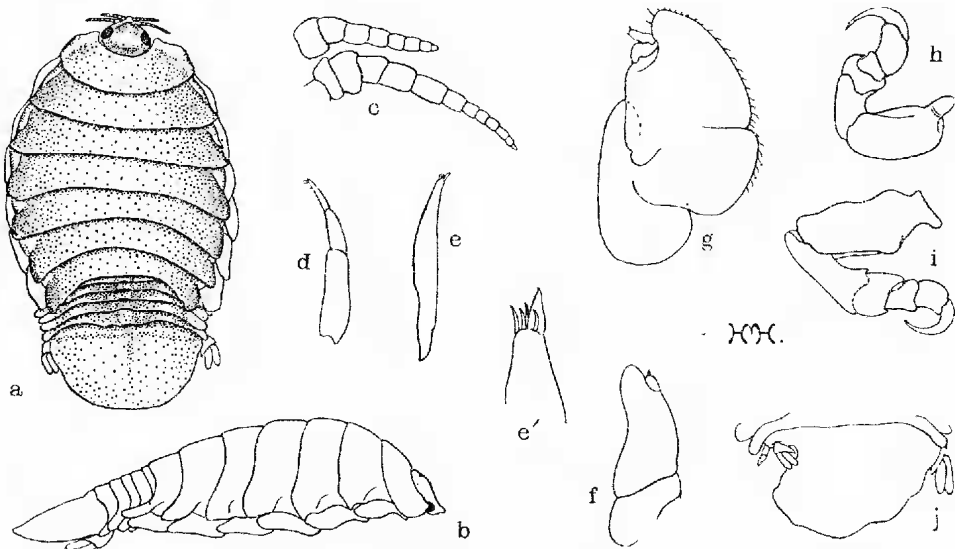


Fig. 10.

Livoneca raynaudii. Ovigerous female: *a* and *b*, dorsal and lateral views ($1\frac{1}{2}$ diam.); *c*, antennae ($6\frac{1}{2}$ diam.); *d*, palp of mandible (10 diam.); *e* and *f*, first and second maxillae (10 diam.); *e'*, apex of first maxilla (42 diam.); *g*, maxilliped ($6\frac{1}{2}$ diam.); *h* and *i*, first and seventh peracopods ($3\frac{1}{2}$ diam.); *j*, abnormal telsonic segment of another specimen (1 diam.).

♂. Differs from the ovigerous female as follows:—Antennae relatively a little longer (but composed of the same number of articles), peraeopods more slender and form narrower, about two and one-third times longer than wide. All coxal plates reaching nearly or quite to level of hinder angles of their segments. Telson a little longer in proportion to its width and more triangular in shape. Male appendage of second pleopods not much shorter than large outer ramus. Branches of uropods with a few short hairs on inner and apical margins; exopod longer than endopod, sometimes reaching to level of apex of pleon.

Length, 17.5-19 mm.

Loc.—New South Wales: Sydney (Raphael), off Cape Three Points, Jibbon, Wata Mooli, and Coogee, 32-78 faths. ("Thetis" Exped.), Terrigal (D. G. Stead), off Botany Bay, 33-56 faths. (C. W. Mulvey, F. A. McNeill, and A. Livingstone), Port Jackson, 65-75 faths., from *Zeus faber* and a Scorpaenid, and off Green Cape, 30-40 faths., from a flathead (W. Boardman and G. P. Whitley). South Australia: Port Adelaide (S. Austr. Mus. Coll.). Tasmania (A. M. Lea).

Hab.—South Africa, Japan, Australia, and New Zealand.

This species is apparently not subject to very great distortion; some specimens are quite symmetrical, others are curved slightly to the left, others to the right. The front of the cephalon may be very narrowly subtruncate, and not or scarcely constricted near the apex. All the coxal plates may extend back to the level of the postero-lateral angles of their respective segments.

The telsonic segment of an abnormal female is shown at *j*, fig. 10; the right uropod is normal, but on the left, and damaged, side two uropods (one of which is uniramous) have been developed.

As remarked by Chilton *L. epimerias*, Richi,⁽⁸⁾ from Japan, is apparently very close to *L. raynaudii*.

***Livoneca turgidula*, n. sp.**

♀. Form somewhat ovate, about twice as long as greatest width. Cephalon not deeply immersed in first peraeon segment, slightly bent downwards anteriorly, and a little longer than basal width; lateral margins concave and front truncate, very slightly convex; dorsum with two shallow, adjoining foveae. Eyes small, suboval, situate at postero-lateral angles of cephalon. Antennae short, composed of eight articles in both pairs; second pair more slender and a little shorter than first. First article of palp of mandibles as long as second and third together;

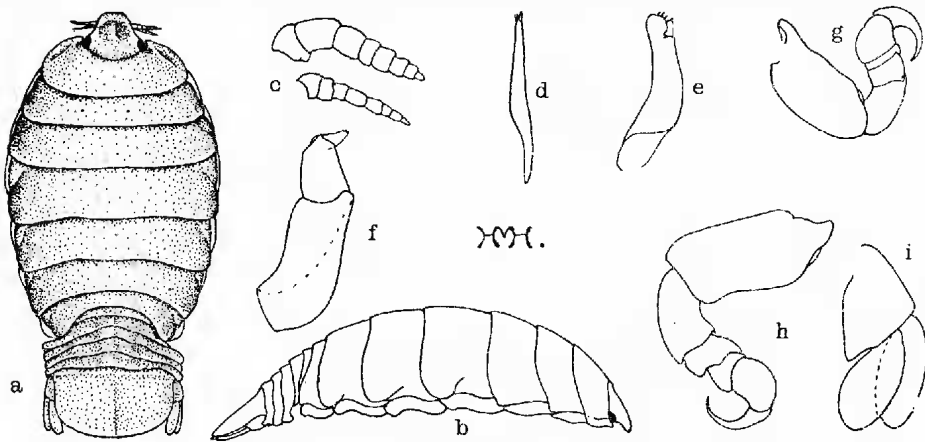


Fig. 11.

Livoneca turgidula, type, female: *a* and *b*, dorsal and lateral views (3 diam.); *c*, antennae (12 diam.); *d* and *e*, first and second maxillae (18 diam.); *f*, maxilliped (18 diam.); *g* and *h*, first and seventh pereopods (8½ diam.); *i*, uropod (8½ diam.).

third about half as long as second, with a few short apical setae. Peraeon moderately convex, suboval in shape; antero-lateral angles of first segment acute, reaching to anterior margins of eyes, and dorsum with a deep groove on each side near lateral margins; first and fourth segments subequal in length, longer than any of the others; second and sixth subequal in length, a little longer than third and fifth segments, which are subequal in length; seventh segment abruptly shorter. Coxal plates thick, very narrow in dorsal view, rounded posteriorly, only the last pair reaching to the posterior angles of their segment. First pleon segment partly concealed beneath last peraeon segment; second to fifth segments subequal in length and width (right lateral portion of second abnormal), as wide as the seventh peraeon segment; telsonic segment nearly twice as wide as medianly long, subrectangular in shape, with postero-lateral margins and hinder margin rounded; dorsum with a low median carina, lightly excavate and shallowly pitted

(8) Rich., Proc. U.S. Nat. Mus., xxxvii, 1910, p. 88, fig. 13.

on each side of carina. Uropods reaching to level of hinder margin of telson, with branches suboval in shape and subequal in length; endopod a little wider than exopod. Peraeopods moderately stout, successively increasing in length; basos of each with a low but distinct carina. Pleopods successively decreasing in size backwards, the outer ramus much wider and longer than inner in the first two pairs, less markedly wider and longer in the three posterior pairs.

Length, 16.5 mm.

♂. Less robust than the female, about two and one-half times as long as greatest width. Male appendage of second pleopods as long as rami.

Length, 10.5 mm.

Loc.—Western Australia: Fremantle (type locality) and Cottesloe (L. Glaupert). Type, female, and allotype, male, in W. Austr. Mus., Reg. Nos. 10034 and 11126.

This species resembles *L. philippinensis*, Rich.,⁽⁹⁾ in the small size, the short antennae, and the irregular lengths of the peraeon segments. Richardson's species differs, however, in having the cephalon wider than long and rounded in front, the telson of different shape, etc.

IRONA, Schiödte and Meinert.

Irona, Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, p. 381; Stebb., Herdman's Ceylon Pearl Fish., Suppl. xxiii., 1905, p. 27; Rich., Bull. U.S. Nat. Mus., liv., 1905, p. 265.

Front of cephalon rather broadly rounded. First segment of peraeon sublunate, longer than the second. Posterior coxal plates usually wide or rather wide. Carina of basos of last four pairs of peraeopods obsolete. Pleon usually strongly immersed in the peraeon, the first segment wholly or for the greater part covered by the last peraeon segment.

Irona is close to *Livoneca*, but one or more of the above somewhat inconstant characters serve to distinguish the females of the species of the genus. No species has been previously noted from Australian coasts, but at least the two following occur:—

KEY TO AUSTRALIAN SPECIES.

- a. Coxal plates thick, comparatively narrow, convex fore and aft, and transversely. Eyes moderately large. Peraeopods stout *renardi*
- aa. Coxal plates thin, wide, and flat. Eyes larger. Peraeopods more slender *melanosticta*

IRONA RENARDI, Bleeker.

Livoneca renardi, Bleek., Acta. Soc. Scient. Indo-Neerland., ii., 1857, p. 28, pl. i., fig. 8.

Livoneca renardi, Miers, Ann. Mag. Nat. Hist., (5) v., 1880, p. 465.

Irona renardi, Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, p. 383, pl. xvi., figs. 10, 11.

♀. Ovigerous. Form irregularly subovate, twice as long as greatest width. Cephalon strongly immersed in first peraeon segment, suborbiculate, about one-third wider than medial length, and with front obtuse. Eyes moderately large. Labrum about one-fourth wider than long; slightly emarginate. Antennae short, the first pair stouter than second; both composed of seven articles. Oral appendages stout. First article of palp of mandibles equal to second and third together; third article short. Basipodite of maxillipeds twice as long as greatest width. Peraeon transversely convex, widest at second and third segments; first segment sublunate, much longer than any of the others, with posterior margin sinuate towards sides; antero-lateral angles narrowly rounded and reaching almost to level of anterior margins of eyes; second segment longer than third, which is longer than the four posterior segments, which are subequal in length. Coxal plates thick, not very wide, convex transversely and fore and aft; first

(9) Rich., Bur. of Fish., Doc. No. 736, 1910, p. 24, fig. 23.

two pairs not reaching to hinder angles of their segments, and last four pairs extending to the posterior angles of their segments; plates of second to fourth segments acutely rounded posteriorly, of fifth to seventh segments obtusely rounded. Pleon deeply immersed in peraeon, which covers the first two segments (the lateral parts of which are, however, visible in lateral view); lateral margins short, almost straight or slightly incised; telsonic segment rounded, not much wider than medial length, as wide as fourth pleon segment; dorsum marked with faint pits. Uropods reaching well beyond apex of pleon; both rami long and narrow, curved or a little sinuate, the endopod shorter and narrower than the

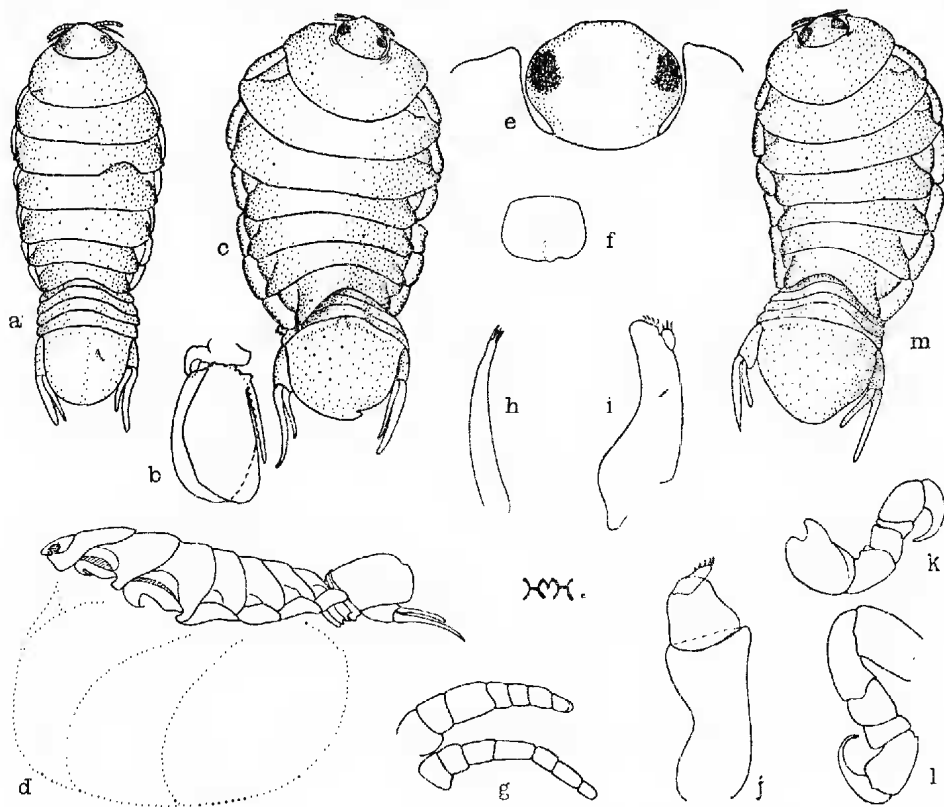


Fig. 12.

Isona renardi. Male: a, dorsal view (2½ diam.); b, second pleopod (4 diam.). Ovigerous female: c and d, dorsal and lateral views (1½ diam.); e, cephalon (5½ diam.); f, labrum (10 diam.); g, antennae (22 diam.); h and i, first and second maxillae (14 diam.); j, maxilliped (11 diam.); k and l, first and seventh peraeopods (4 diam.). m, Dorsal view of another female (2½ diam.).

exopod. Peraeopods stout, successively increasing in length backwards; dactyli strong; seventh peraeopods a little longer than sixth.

Colour in alcohol: White with small chromatophores on the telson, uropods, and pleopods.

Length, 29 mm.

♂. The form is subovate and is more slender (two and one-half times longer than wide) and more symmetrical, and the cephalon is relatively larger than in the ovigerous female. First antennae composed of eight articles, the second of nine. Peraeon widest at third segment; first segment longest, with

antero-lateral angles subacute, reaching to level of middle of length of eyes. Coxal plates of second to fourth segments subtruncate posteriorly, of fifth to seventh segments obtusely rounded. All segments of pleon visible in dorsal view. Male appendage of second pleopods not nearly reaching to end of rami.

Colour: Whitish, closely dotted with small chromatophores, which are most distinct posteriorly.

Length, 19 mm.

Loc.—New South Wales: Georges River, Botany Bay (J. H. Wright), under gill-cover of *Tylosurus ferox* (D. G. Stead), Port Jackson, and Camden Haven, under gill-cover of *Tylosurus macleayana* (Austr. Mus. Coll.). Queensland: Townsville, from *Tylosurus* sp. (Dr. W. E. J. Paradise). Western Australia: Fremantle (W. Austr. Mus. Coll.).

Hab.—India, Philippine Islands and Australia (? Batavia-Bleeker).

The male and female described and illustrated above were taken together at Sans Souci, Georges River; a second ovigerous female, 24.5 mm. in length, from Queensland, is shown at *m*, fig. 12. In females which are curved to the left the pleon is tilted to the right, and on this side is more or less overlapped by the postero-lateral portion of the peraeon; a reverse condition obtains in specimens curved to the right. At least the first pleon segment is concealed beneath the peraeon in the ovigerous female; the peraeon is not consistently subovate, and in one example it is suboval.

Three males which, apparently, should be referred to this species were taken from *Tylosurus macleayana* in New South Wales. The smallest of these is 16.5 mm. in length, is three times as long as wide, and has the telson elongate, longer than wide; both branches of the uropods are ciliate, and the exopod is slightly longer and narrower than the suboval endopod. A second specimen is 17.5 mm. in length, and is little more than two and one-half times as long as wide; the telson is scarcely wider than long, and the uropods are more as in the male described in detail above, but are relatively shorter. The third example is 23 mm. in length; the male appendage of the second pleopods is much shorter than the rami.

IRONA MELANOSTICTA, Schioedte and Meinert.

Irona melanosticta, Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, p. 388, pl. xvii., figs. 3-5; Thielemann, München Abh. Akad. Wiss., ii., Suppl. 3, 1911, p. 45, pl. ii., figs. 28, 29; Barn., Ann. S. Afr. Mus., x., 1914, p. 373.

♀. Ovigerous. Form irregularly suboval, twice as long as greatest width. Cephalon immersed in first peraeon segment, suborbiculate, wider than long, with front obtuse. Eyes large. Labrum slightly emarginate. First antennae much stouter than second, composed of eight articles; second pair composed of nine articles. Oral appendages rather slender. First and second articles of palp of mandibles subequal in length, each two and three-fourths as long as third. Basipodite of maxillipeds two and one-half times longer than greatest width. Peraeon slightly convex transversely, widest at fourth segment; first segment sublunate, as long as the third, and a little longer than second segment, with posterior margin a little sinuate towards sides; antero-lateral angles rounded, reaching to level of eyes; four posterior segments successively decreasing in length backwards. Coxal plates wide and rather thin, slightly convex fore and aft, and continued quite or nearly in the same plane as their segments; plates of second segment reaching to postero-lateral angles of their segment and remaining plates extending distinctly beyond hinder angles of their segments; first three pairs with outer margins more or less sinuate and posterior apices rounded; last three pairs with outer margins convex and apices rather narrowly rounded; plates of third and fourth segments longer than the others. Pleon immersed in peraeon, the first segment not wholly concealed; first four segments subequal in length, fifth

a little longer; lateral margin of anterior five segments rounded; posterior portion of telson membranaceous, with shallow pits, the hinder margin irregular; the greater part of the telsonic segment is more strongly chitinized than the hinder portion; this firm portion is twice as wide as medianly long, semicircular in shape

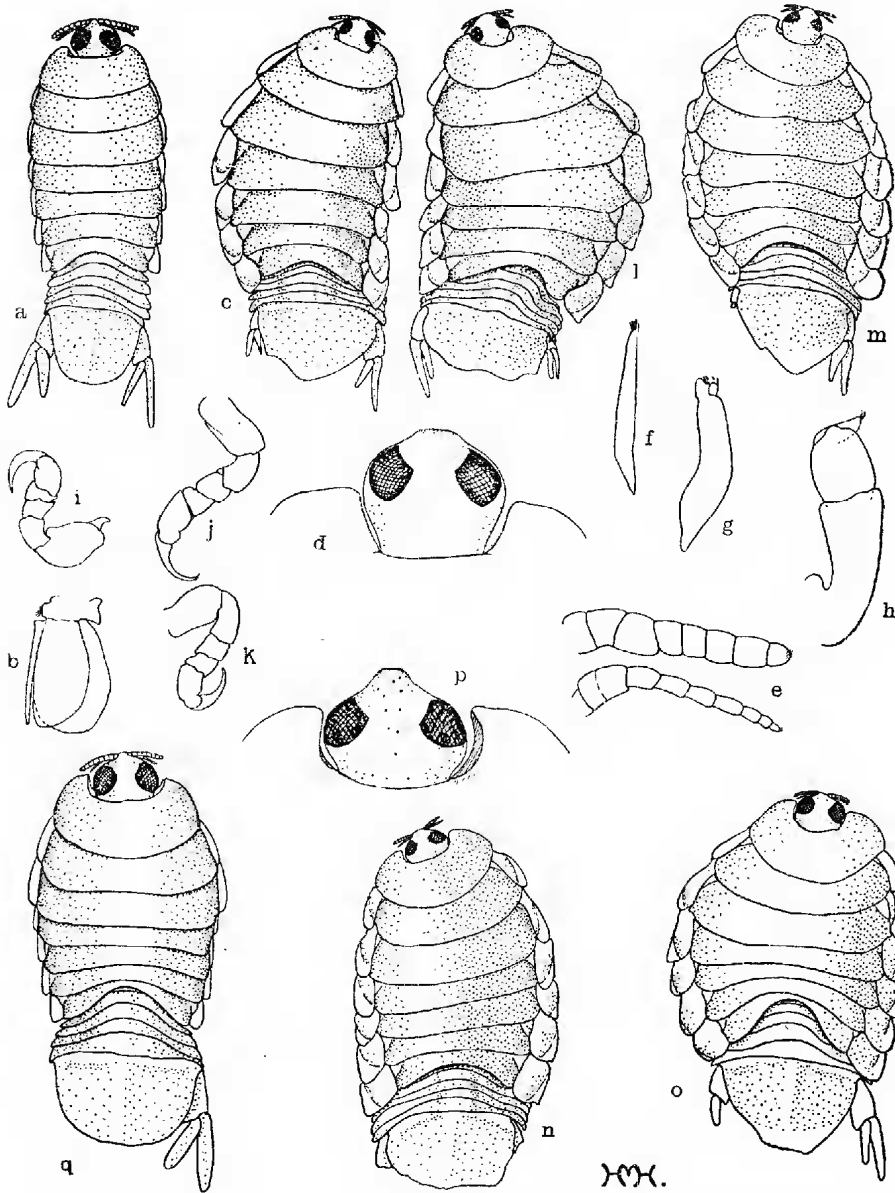


Fig. 13.

Irona melanosticta. Male: *a*, dorsal view ($3\frac{1}{2}$ diam.); *b*, second pleopod (6 diam.). Ovigerous female: *c*, dorsal view (3 diam.); *d*, cephalon ($8\frac{1}{2}$ diam.); *e*, antennae (21 diam.); *f* and *g*, first and second maxillae (21 diam.); *h*, maxilliped (21 diam.); *i*, *j*, and *k*, first, sixth, and seventh peracopods (6 diam.). *l*, *m*, *n*, and *o*, Dorsal views of other ovigerous females (2 to $3\frac{1}{2}$ diam.). *p*, Cephalon of ovigerous female ($8\frac{1}{2}$ diam.) *q*, Dorsal view of another male ($4\frac{1}{4}$ diam.).

posteriorly, and faintly pitted. Left uropod abnormal, with rami rather short and subequal in length; right uropod reaching well beyond apex of pleon, both branches thin and narrow, the exopod very slightly sinuate and longer and slightly wider than endopod. Peraeopods moderately stout, successively increasing in length backwards to the fifth pair; seventh peraeopods not longer than sixth.

Colour in alcohol: Brownish, paler on telson.

Length, 17 mm.

♂. The form is subovate and is more slender (two and three-fourths times as long as greatest width) and more symmetrical, and the cephalon is relatively larger than in the ovigerous female. First antennae composed of eight, and second of nine articles. Peraeon widest at third segment; first segment longest, with antero-lateral angles rounded and not very produced. Coxal plates of second and third segments obtuse posteriorly, larger than the remaining pairs, which are narrowly rounded posteriorly; telsonic segment a little wider than medial length, posterior margin rounded and dorsum shallowly pitted and with a low median carina. Male appendage of second pleopods reaching to level of apex of inner ramus. Both rami of uropods reaching well beyond apex of pleon, the exopod longer and wider than the endopod.

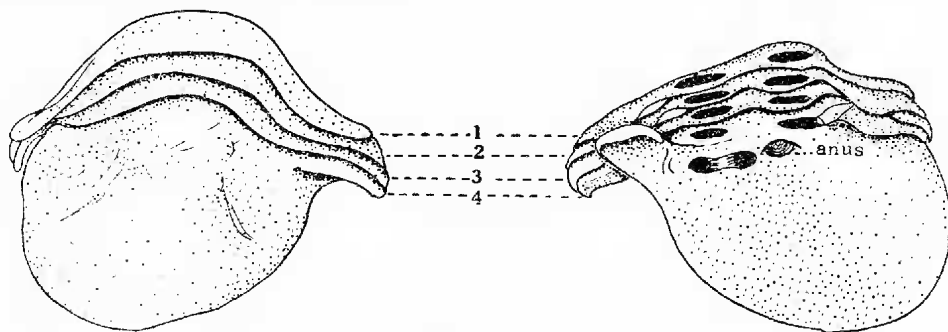


Fig. 14.

Irona melanosticta. Dorsal and ventral views of abnormal pleon of ovigerous female; pleopods removed (5 diam.).

Colour: Brownish, paler on telson.

Length, 14 mm.

Loc.—South Australia: Port Victor (Bradley), Gulf St. Vincent, and Port Adelaide (S. Austr. Mus. Coll.).

Hab.—Japan, Sandwich Islands, Australia, and South Africa.

The coxal plates of the ovigerous female of this species are very different from those of *I. renardi*. Eighteen specimens, all taken from beneath the gill-covers of garfish (*Hyporhamphus intermedius*), are before me; the largest female is 25 mm. in length. The "long toms" (*Tylosurus*, from which some specimens of the preceding species were taken) do not occur in South Australia, but Thielemann notes that *I. melanosticta* is found on "*Belone* sp." in Japan, and Barnard records it from "*Tylosurus choram*" in South Africa.

The cephalon is somewhat variable in shape and may be apically obtuse or (rarely) somewhat triangular, with the antero-lateral margins sinuate (fig. 13, *p*). The form may be relatively much wider than in the examples described above owing to greater distortion or "telescoping" of the segments of the peraeon, as in the male shown at *q*, and in the ovigerous females at *l*, *m*, and *o*. The coxal plates are variable in size and shape, but are always thin and nearly flat; more or less of the postero-lateral part of each is softer and somewhat thicker than the rest.

but in dried examples this fleshy portion shrinks and becomes thin and membranaceous. In some specimens the pleon is far more deeply immersed in the peraeon than in others (cf. females *n* and *o*). The hinder margin of the membranaceous posterior part of the telson of the ovigerous female is almost always irregular, but the more strongly chitinized, semicircular basal part is consistently about twice as wide as long, as in the example figured by Schiøedte and Meinert. In this sex the uropods are commonly abnormal on one side or the other (sometimes on both sides), but the uropods of the male, and normal uropods of the female, are as described by Barnard.

One much distorted ovigerous female presents an abnormality of some interest. This example is curved to the left, and the pleon (fig. 14) consists of only four separate segments, the fourth and fifth being fused with the telsonic segment, so that the last two pairs of pleopods are attached to the underside of the enlarged "telson." The first three segments are twisted but distinct, and the fourth is represented by a short lateral piece on the right side. The lateral portions of the anterior margin of the telsonic segment are decurved. Uropods are wholly absent.

CODONOPHILUS, Haswell.

Codonophilus, Hasw., Proc. Linn. Soc. N.S. Wales, v., 1881, p. 471, and Cat. Austr. Crust., 1882, p. 283.

Ceratothoa, Sch. and Mein., Naturh. Tidsskr., (3) xiii., 1883, p. 322 (*nec* Dana, 1853).

Meinertia, Stebb., Hist. of Crust., 1893, p. 354, and Mar. Invest. S. Afr., i., 1900, p. 57, and Ann. S. Afr. Mus., vi., 1910, p. 424.

The cephalon is more or less immersed, but its hinder margin is not trilobate. The first pair of antennae are expanded and are basally contiguous. The first peraeon segment has the anterior margin almost straight, or more or less strongly bisinuate, and the antero-lateral angles forwardly produced. The coxal plates are thick and prominent. The pleon is immersed in the peraeon. The first three pairs of peracopods are shorter than the others; the basos of the posterior peraeopods is expanded.

As before, the generic diagnosis applies to the mature adults. As noted below Haswell's *Codonophilus* was founded upon an immature specimen of Fabricius' *Cymothoa imbricata*. Unfortunately, Haswell's genus antedates *Meinertia* of Stebbing, so that the species referred to the last-named genus must now be transferred to *Codonophilus*.

CODONOPHILUS IMBRICATUS, Fabricius.

Oniscus imbricatus, Fabr., Mantissa Insect., i., 1787, p. 241.

Cymothoa imbricata, Fabr., Entom. Syst., ii., 1793, p. 503, and Suppl., 1798, p. 304.

Cymothoa banksii, Leach, Dict. Sci. Nat., xii., 1818, p. 353; M. Edw., Hist. Nat. Crust., iii., 1840, p. 273; Krauss, Die Südafrikanischen Crust., 1843, p. 66; Heller, Reise der Novara Crust., 1868, p. 148.

Cymothoa trigonocephala, Leach, *loc. cit.*, p. 353; M. Edw., Ann. Sci. Nat., (2) iii., 1835, pl. xiv., figs. 1, 2, and Règne Animal (1839 ?), pl. lxxv., fig. 2, and Hist. Nat. Crust., iii., 1840, p. 272.

Ceratothoa trigonocephala, Heller, *loc. cit.*, p. 148; Thomson, Trans. N. Z'd. Inst., xi., 1879, p. 233; Miers, Ann. Mag. Nat. Hist., (5) v., 1880, p. 463; Hasw., Cat. Austr. Crust., 1882, p. 282; Sch. and Mein., Naturh. Tidsskr., (3) xiii., 1883, p. 358, pl. xvi., figs. 1-7.

Ceratothoa banksii, Miers, Cat. Crust. N. Z'd., 1876, p. 105; Sch. and Mein., *loc. cit.*, p. 340, pl. xiv., figs. 6-21; Hansen, Cirolanidae, 1890, p. 68, pl. x., fig. 4.

Codonophilus argus, Hasw., Proc. Linn. Soc. N.S. Wales, v., 1881, p. 471, pl. xvi., figs. 1, 1c, and Cat. Austr. Crust., 1882, p. 283.

Ceratothoa imbricata, Miers, Zool. "Alert," 1884, p. 300.

Meinertia imbricata, Stebb., Hist. of Crust., 1893, p. 354, and Mar. Invest. S. Afr., i., 1900, p. 58, and Ann. S. Afr. Mus., vi., 1910, p. 424; Chilton, Trans. N. Z'd. Inst., xliii., 1911, p. 567.

Meinertia trigonocephala, Thielemann, München Abh. Akad. Wiss., ii., Suppl. 3, 1911, p. 35, pl. i., figs. 8, 9.

The following variation is evident in ovigerous females:—Cephalon subtriangular, longer than wide, sometimes three-fourths as long again as basal width; apex obtuse or subacute, the front occasionally considerably narrowed; lateral margins rounded and scarcely sinuate, or emarginate. Eyes usually distinct, rhomboidal or suboval, usually with inner margins almost straight. Normally, the first antennae are composed of seven articles and the second of nine. Produced antero-lateral parts of first peraeon segment wide and apically rounded, or tapering and apically acute; anterior margin of first segment nearly straight (slightly concave or convex) or more or less bisinuate (occasionally conspicuously so). Fifth segment of pleon with hinder margin more or less distinctly trisinate; telsonic segment about twice as wide as medial length, rarely perfectly symmetrical, with hinder margin rounded. Normally the rami of the uropods are narrow, falcate, and subequal in length (fig. 15, *i*).

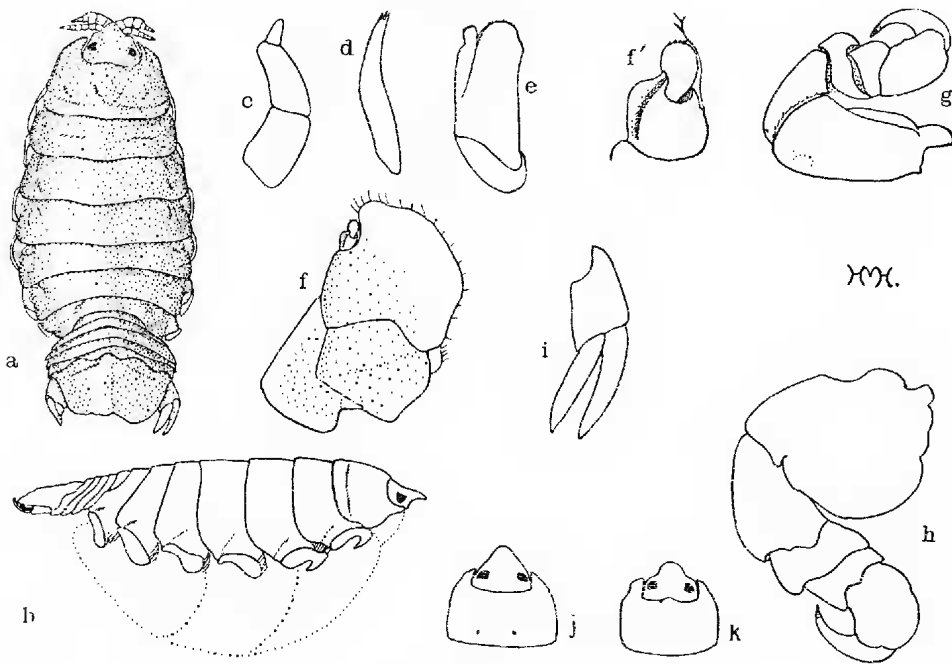


Fig. 15.

Codonophilus imbricatus. Ovigerous female: *a* and *b*, dorsal and lateral views (1½ diam.); *c*, palp of mandible (8 diam.); *d* and *e*, first and second maxillae (8 diam.); *f*, maxilliped (6 diam.); *f'*, palp of maxilliped (19 diam.); *g* and *h*, first and seventh peracopods (4 diam.). *i*, Uropod of a smaller female (8 diam.). *j* and *k*, Cephalon and first peracopod segment of two other examples (1½ diam.).

The smallest of the ovigerous females before me is 16.5 mm. in length, the largest 49 mm.; Stebbing states that the female attains a length of 57 mm. The ova of one of the small examples are, approximately, 2 mm. in diameter; those of a very large female are slightly larger.

An ovigerous female 44 mm. in length is illustrated in fig. 15, *a* to *h*: the cephalon and first peraeon segment of two smaller specimens, taken from the tongue of a mullet, are shown at *j* and *k*.

The species has been recorded from the Indian Ocean, Java, New Zealand, Australia, and South Africa. It is moderately common in Australian waters, and there is before me a series of more than one hundred adult specimens from various

localities off the eastern, southern, and western coasts. In the majority of cases the host is not noted, but some labels show that the parasite occurs in the mouth or under the gill-cover of the yellow-tail (*Trachurus declivis*), schnapper (*Pagrosomus auratus*), red gurnard (*Chelidonichthys kumu*), blackfish (*Girella tricuspidata*), trevally (*Caranx georgianus*), and mullet (*Mugil*).

Miers (*ut supra*, 1884) compared Fabricius' type of *Cymothoa imbricata* with the type examples of *C. trigonocephala*, Leach, and states that it is probable that the last-named species is synonymous with the first; he adds that he keeps them provisionally distinct because in the type of *C. trigonocephala* "the head is narrower, more distinctly triangulate, with straight sides, and the anterior thoracic segment proportionately longer than is usual in *C. imbricata*." Stebbing (1900) remarks on the difference in the anterior margin of the first peraeon segment of the ovigerous females figured by Schioedte and Meinert; the Danish authors show this margin as conspicuously bisinuate in the female figured by them as *Ceratothoa trigonocephala* and nearly straight in the female they designate *C. banksii*. In their figures of the males of the two species, however, the condition

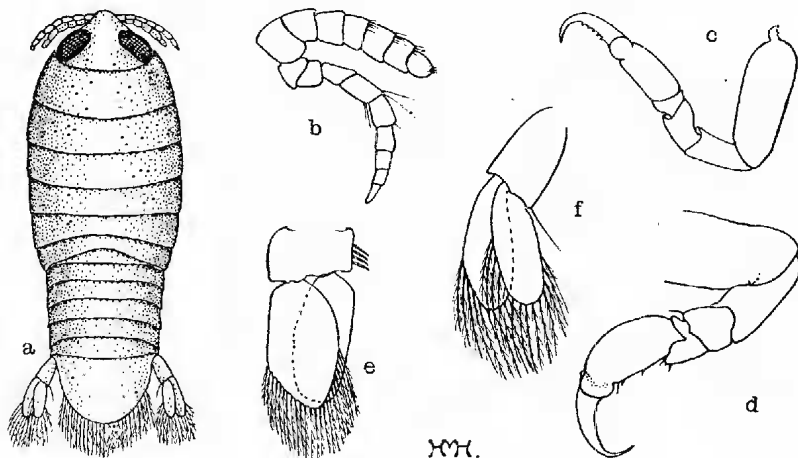


Fig. 16.

Codonophilus imbricatus, juvenile (Haswell's type specimen of *C. argus*): a, dorsal view (13 diam.); b, antennae (39 diam.); c and d, first and sixth peraeopods (29 diam.); e, second pleopod (39 diam.); f, uropod (39 diam.).

appears to be reversed. In 1910 Stebbing definitely sinks *Cymothoa trigonocephala*, Leach, in the synonymy of *Meinertia imbricata*, and notes that probably *Ceratothoa trigonocephala* of Schioedte and Meinert is also a synonym. The variability of the Australian specimens leaves one in no doubt concerning this last reckoning.

Advanced young taken from the brood-pouch of a female are 4 mm. to 4.6 mm. in length, and differ from the adult in having the form symmetrical, the eyes large and conspicuous, the antero-lateral angles of the first peraeon segment scarcely produced, and the last peraeon segment short. Also, the inner edge of the dactylus of the anterior peracopods is dentate, the seventh pair of peraeopods is not developed, the telson is fringed with long, delicately plumose hairs, and the rami of the uropods are suboval in shape and fringed with long plumose hairs. Schioedte and Meinert give the lengths of the young of the first and second stage as 3.5 mm. and 3.6 mm., respectively, under the name *Ceratothoa trigonocephala*, and as 4.2 mm. and 5 mm. under the name *C. banksii*.

The type specimen of *Codonophilus argus*, Hasw. (fig. 16), is 4 mm. in length ("5/32 in.") and is identical with advanced brood young of *Meinertia imbricata*. Haswell evidently made a superficial examination of the specimen upon which he founded his genus, for he states that the pleon has the "Terminal segment scale-like, acuminate," and that the uropods are "uniramous . . . Ramus . . . falciform with a few scattered cilia." When the type specimen is lifted out of the alcohol in which it is preserved and examined under the microscope, the wet, fringing, plumose hairs of the uropods and apical part of the transparent telson tend to converge to a point (like a wet camel-hair brush), and there is little doubt that this conveyed the impression that the telson and uropods were apically acute. Further, when the type was first examined by me the endopod of each uropod was closely overlying the exopod, and the matting of the marginal hairs held the two branches thus superimposed, producing the "uniramous" appearance; the "few scattered cilia" were evidently some projecting ends of the plumes of the fringing hairs. This specimen is of importance, as it necessitates the sinking of the generic name *Meinertia*, and the above rather obvious explanation is given because it is felt that it may be suspected that the example is incorrectly labelled as Haswell's type. There is, however, no doubt on that score. Haswell figures the maxilliped and the ischium, merus, carpus, propodus, and dactylus of the right peraeopod of the first pair; when first now examined the type had only these parts missing, the basos of the first peraeopod of the right side being still attached. I have removed, stained, and mounted the parts here illustrated, and also the first and second maxillae. It is noted on the type label that the example was taken "from *Crambessa mosaica*, in Port Jackson, New South Wales."

It is well to recall here that Richardson⁽¹⁰⁾ remarks that *Aegathoa* of Dana "perhaps represents the young of *Livoneca*. The figure given by Schiödte and Meinert of the young female of *Livoneca redmanni* does not apparently differ from *Aegathoa oculata* (Say). I have not suppressed the genus, however, because I could not be positive of the identity of these forms."

OUROZEUKTES, Milne Edwards.

Ourozeuktes, M. Edw., Hist. Nat. Crust., iii., 1840, p. 275.

Urozeuctes, Sch. and Mein., Naturh. Tidsskr., (3) xiv., 1884, p. 404.

Basal half of cephalon immersed in first peraeon segment. Bases of antennae widely separated; first pair a little compressed. First peraeon segment medianly longer than any of the others. Coxal plates thick and subpendulous. Last four pairs of peraeopods successively increasing in length backwards. Pleon unisegmentate, moderately immersed in peraeon.

As noted by Milne Edwards, in the young stages *Ourozeuktes* is similar to the juveniles of other Cymothoidae; the adult female, however, is strikingly distinguished from all other members of the family by the following characters:—The dactyli of the peraeopods are rather small; the basos and ischium of the last four pairs are expanded, on the lower edge, in the form of a lamella furnished with blood vessels. The segments of the pleon, excepting at the extreme lateral portions, are solidly coalesced, but the suture lines are distinct. The telson is submembranaceous; both the telson and the pleopods are supplied with large blood vessels. The exopods of the first pair of pleopods are much enlarged, overlapping below, and reaching almost to, or a little beyond, the level of the apex of the telson, while their lateral parts are thickened and are recurved over the sides of the pleon; the lamellar expansion of the protopod of the second to fifth pleopods is very well developed.

(10) Rich., Bull. U.S. Nat. Mus., liv., 1905, p. 216.

OUROZEUKTES OWENII, Milne Edwards.

Ourozeuktes owenii, M. Edw., Hist. Nat. Crust., iii., 1840, p. 276, pl. xxxiii., fig. 8; Heller, Reise der Novara. Crust., 1868, p. 148; Hasw., Cat. Austr. Crust., 1882, p. 283; Lucas, Bull. Soc. ent. Franc., v. 1885, p. lvi.iii.; Jennings, Journ. Linn. Soc., xxv., 1896, p. 329, pls. xiii., xiv.

Ourozeuktes pyriformis, Hasw., loc. cit., p. 283.

Urozeuktes owenii, Gerstaecker, Bronn's Thier-Reichs, Band. v., Abth. 2, pl. viii., fig. 20 (1881), and pl. xxvi., fig. 1 (1883); Sch. and Mein., Naturh. Tidsskr., (3) xiv. (1884), p. 405, pl. xviii., figs. 5-7.

Urozeuktes monacanthini, Sch. and Mein., loc. cit., p. 407, pl. xviii., figs. 8, 9.

Urozeuktes caudatus, Sch. and Mein., loc. cit., p. 411, pl. xviii., figs. 11, 12.

♀. Ovigerous. Form broadly obovate. Cephalon suborbiculate, much wider than long and with anterior margin emarginate. Eyes distinct, rather small, situate laterally. First antennae stouter than second; composed of seven articles, the first three of which are indistinctly separated; first article as wide, and more than half as long, as second, which is very large, nearly as long as the three terminal articles together; second antennae nine-jointed, the last three

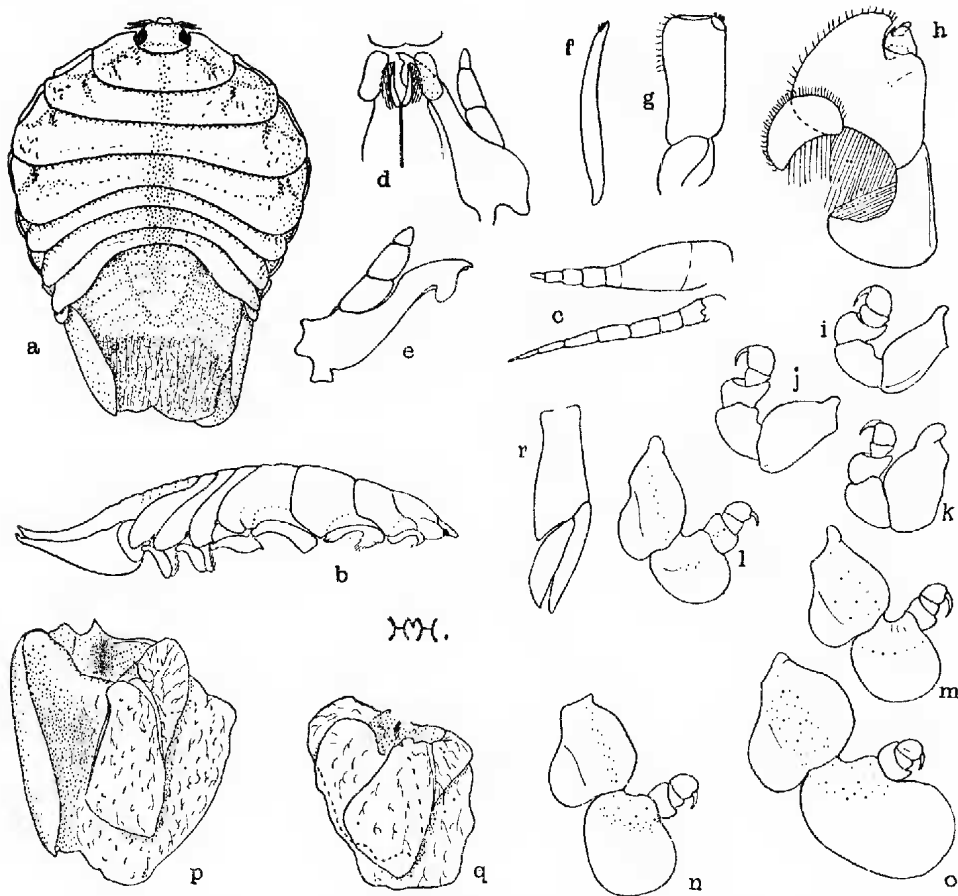


Fig. 17.

Ourozeuktes owenii. Ovigerous female: a and b, dorsal and lateral views ($1\frac{1}{2}$ diam.); c, antennae (8 diam.); d, mandible of left side, labium, and margin of labrum (8 diam.); e, mandible (8 diam.); f and g, first and second maxillae (8 diam.); h, maxilliped (7 diam.); i to o, first to seventh pereopods (2 diam.); p and q, ventral view of first and third pleopods (2 diam.); r, uropod ($3\frac{1}{2}$ diam.).

articles reaching beyond apex of first antennae. Labrum visible in dorsal view, emarginate. Mandibles tapering towards distal end, which is directed inwards and is apically acute; below the extreme apex is a tiny, keen-edged lobe which, like the remainder of the cutting edge, is strongly chitinized; inner margin behind cutting edge produced into a thin, prominent lobe. Palp stout, the first article nearly as long as second and third together; third article short. First maxillae styliform, with the strongly chitinized, toothed apex lying in the emargination of the labrum, slightly behind the apices of the mandibles. Second maxillae wide, transversely curved, somewhat obscurely bilobed, the inner lobe small, with one or two spines. Peraeon widest at third and fourth segments; antero-lateral angles of first segment acutely rounded, reaching to level of middle of length of eyes; first four segments impressed and rugose laterally, and with antero-lateral portions tumid; each of last three segments shorter than any of others. Coxal plates of second and third segments reaching back to the postero-lateral angles of their segments; remaining plates not reaching to this level. First pleon segment partly concealed beneath last peraeon segment, with lateral parts free, each produced into a small lobe, which overlies the basal part of the exopod of the first pleopod, and reaches back to the level of the posterior angles of the third segment; a small lateral portion of each of the second to fifth segments free, lobular. Uropods reaching to apex of pleon; protopod as long as, or longer than, rami; branches of the uropod of one side apically rounded, of the other acute; endopod wider, and longer or shorter, than exopod. Peraeopods each with propodus and dactylus short; lamellae of basos and ischium of last four pairs successively increasing in size backwards; basos of seventh pair (with lamella) as wide as long; lamella of ischium of these peraeopods very large, much longer than basos. Pleopods of second to fifth pairs successively decreasing in size backwards; endopod of first pair much shorter and very much narrower than exopod, that of second and third pairs a little shorter and much narrower than exopod; that of fourth and fifth pairs as long as, but much narrower than exopod; endopod of all pleopods obliquely subtruncate posteriorly; lamellar expansion of protopod of second to fifth pleopods greatly developed and similar in structure to the endo- and exopod; lamella of the last two pairs almost as long as exopod.

Colour: Whitish, with a smoky median stripe on peraeon and anterior part of pleon, and with telson black.

Length, 43 mm.

♂. Form symmetrical, narrowly obovate, three times as long as greatest width. Cephalon large, wider than long, with anterior margin emarginate. Eyes large and conspicuous. First antennae stouter than second, composed of eight articles, the basal two of which are not conspicuously larger than the others. Second antennae composed of nine articles. Mandible much as in adult female, but with palp setose near apex. Second maxillae slender, with a single hooked spine at apex of terminal article. First segment of peraeon longer than any of the others. Pleon with six distinct segments; telsonic segment posteriorly rounded and fringed with hairs. Endopod of uropods only half as long as exopod, sub-oval in shape; exopod elongate, rather narrow. Peraeopods not very stout and not expanded; each with propodus and dactylus long; propodus of first pair with three spines and carpus with one spine, on inner edge; merus with a spine at outer distal angle and dactylus serrated on inner edge. Pleopods each with two lamelliform rami; male appendage of second pair longer than endopod.

Colour: Yellow, dotted with chromatophores on cephalon, peraeon and first five segments of pleon; more abundantly pigmented chromatophores form a dark median stripe, and another on each side. Telson transparent. Protopod and exopod of uropods with a line of chromatophores along outer edges.

Length, 7 mm.

Loc.—New South Wales: Parramatta River, from *Cantherines granulatus*, Port Jackson, from *Cantherines hippocrepis*, etc., and Georges River, Botany Bay (Austr. Mus. Coll.), Laurieton, from *Cantherines trachylepis* (D. G. Stead), Maroubra Beach, from *Cantherines hippocrepis* (G. P. Whitley), Kurnell, Botany Bay, from *Cantherines* sp. (W. A. Rainbow), Port Hacking, from *Cantherines* sp. (Miss M. Henry). South Australia: Gulf St. Vincent, from *Cantherines guntheri* (A. E. Waterman), from *Cantherines hippocrepis* (F. K. Boase, etc., and "from a shark" (?) (Dr. Cleland), Whyalla, from *Cantherines setosus* (Dr. Souter), Port Willunga, from *Cantherines setosus* (S. Howe), Largs Bay, from *Cantherines* sp. (A. E. Andrew). Western Australia: Bunbury, from *Cantherines* sp. (W. J. Kimber), Cottesloe and Swan River, from leatherjackets, and Fremantle (W. Austr. Mus. Coll.).

Hab.—South-eastern, southern, and south-western coasts of Australia, Kerguelen (*sic* Jennings).

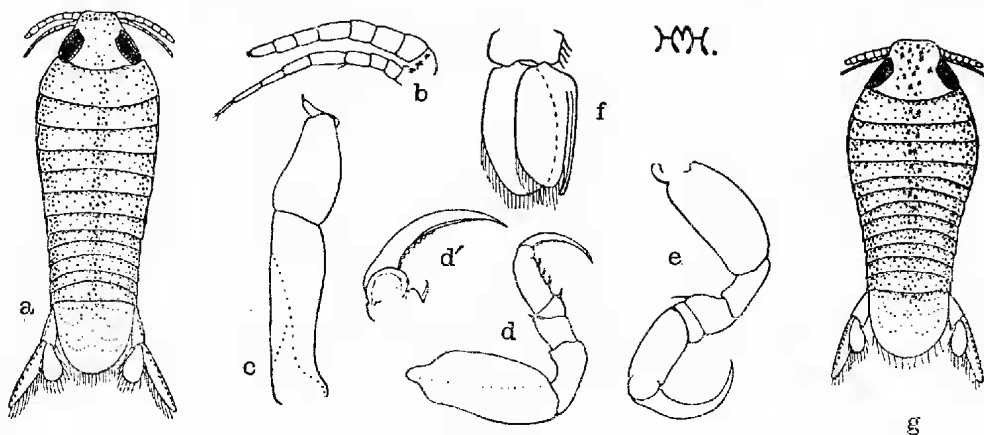


Fig. 18.

Ourozeuktes owenii. Male: *a*, dorsal view (74 diam.); *b*, antennae (20 diam.); *c*, maxilliped (40 diam.); *d* and *e*, first and seventh pereopods (20 diam.); *d'*, dactylus of first pereopod (40 diam.); *f*, second pleopod (20 diam.). *g*, Dorsal view of juvenile from marsupium (25 diam.).

Seven males, one of which is described above, were found with a female collected in South Australia. In this female the marsupium is not completely developed; the males were nestling under the basal joints of the pereopods, outside the oostegites. It is improbable that these males have attained their maximum size and development, and it may be that, as suggested by Jennings, protandrous hermaphroditism occurs in this genus. Males 5 to 8 mm. in length were found under the legs of other females in which the oostegites are not developed.

Several females have juveniles in the brood pouch corresponding to the "pullus stadii primi" described by Schioedte and Meinert under their *Urozeuktes monacanthini*; these average 2.7 mm. in length and 1.1 mm. in width, and have the usual characters of immature Cymothoids (fig. 18 *g*). The modifications peculiar to *Ourozeuktes* take place during growth.

More than fifty females of various sizes are before me; the largest is 52 mm. in length. In an example 11 mm. in length (fig. 19, *a*) the cephalon is relatively larger than in more advanced specimens, the antennae and mouth parts are still much as in the male, and the peraeon is not much widened. The propodus and dactylus of the pereopods are relatively shorter than in the brood young, but

much longer than in large females; the foliaceous expansions of the last three pairs are slightly developed. The pleon segments are coalesced and the telson is smooth and membranaceous; the pleopods and telson are not richly supplied with blood-vessels, but the exopods of the first pleopods reach to the end of the pleon.

In very large ovigerous females the peraeon is usually relatively wider than in smaller egg-bearing specimens. The pleon of the adult female (when perfect) is subtriangular in shape, somewhat variable in relative length, tapers to the narrowly rounded or narrowly subtruncate apex, and has the lateral margins downbent; the apical part of the telson is, however, very often damaged and irregular. The cephalon is more elongate in some specimens than in others, and in one instance is almost as long as its basal width. A sooty, median stripe is often present on the peraeon, but some examples (during life) are white, without pigmentation excepting on the telson; in others the peraeon is lightly sprinkled with tiny chromatophores.

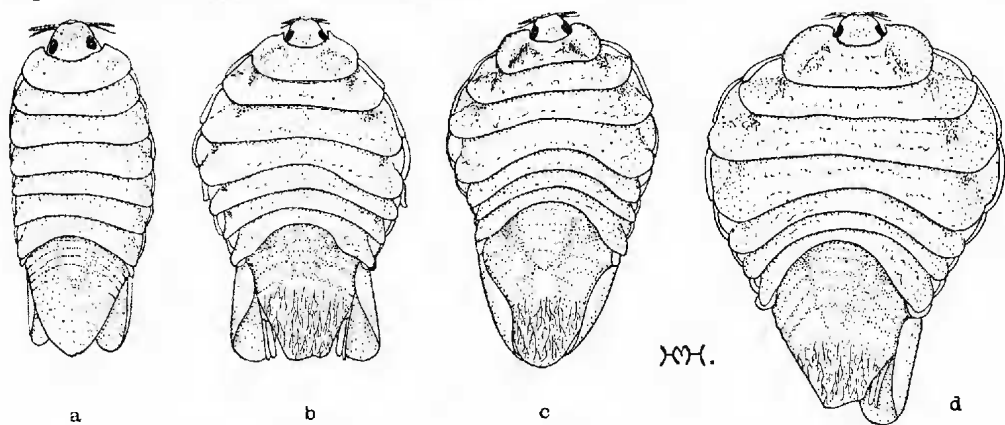


Fig. 19.

Ouzoeuktes owenii. a, Young female (3 and three-fifths diam.). b and c, Ovigerous females (1½ diam. and nat. size). d, Ovigerous female, syntype of *O. pyriformis*, Haswell (nat. size).

The characters quoted by Schioedte and Meinert as separating their *O. monacanthini* and *O. caudatus* from *O. owenii* are unstable; the Danish authors founded the first species upon a single specimen 24 mm. in length from Sydney, and the second upon a single, badly preserved South Australian specimen of the same length. It may be remarked, however, that the pleon of the type of *O. monacanthini* is apparently relatively smaller than in any of the specimens now examined. Haswell applied the provisional name *O. pyriformis* to two large females (fig. 19, d), which only differ from the type figure of *O. owenii* in having the telson more perfect (not abbreviated) and the peraeon relatively wider anteriorly.

Considering that *Ouzoeuktes* was described eighty-five years* ago, it appears, strangely enough, that no detailed note has been published concerning its habits. Milne Edwards' female was without data ("Patrie inconnue"), but Heller records the species from Sydney, and Lucas, in 1885, mentions a specimen taken "dans la poche branchiale d'un *Monacanthus melanurus*, Rich.," (? *M. megalourus*, Rich.) from Port Jackson. A. Gerstaecker copies M. Edwards' figure in the Thier-Reichs, and adds an illustration of a young stage. Schioedte and Meinert describe the beast under three different names and furnish the information that their *O. monacanthini* was taken "cavitate

abdominali' (?) *Monacanthini vittati promptum est.*" Haswell gives a translation of M. Edwards' specific description, and adds a short diagnosis of the pear-shaped form which he considers distinct. Jennings describes a female said to have been obtained by a sailor "at sea near Kerguelen Island," and furnishes figures (some of which are not very accurate) of the animal and its parts. Finally, occasional casual references to the genus have appeared in literature.

Jennings' conjectures as to the habit of *Ourozeuktes* are entirely wrong; he decided that the "hinder limbs are very efficient swimming organs" and that the adult animal "has the power of living freely, though doubtless parasitic at times." As a matter of fact, it may be almost claimed that *Ourozeuktes* is an endoparasite, for, like *Ichthyoxenus*, it burrows into the sides of fishes, is for the greater part concealed within the body thereof and, when adult, is unable to leave its host. From the material in hand it would appear that leather-jackets (*Monacanthidae*) are almost always chosen; according to the reports of fishermen and others, *Ourozeuktes* is anything but rare, and is found only in fishes of this family. The majority of specimens in our collections have been removed from their hosts, but it has been possible to examine some leather-jackets with the parasites *in situ*, and the following observations result:—The crustacean enters the body cavity of its host some distance behind and below the pectoral fin (sometimes very close to the anus), but is never completely concealed, the posterior parts of the telson and pleopods protruding through the entrance slit (pls. xxxvi., xxxvii.). It lies always with the venter pressing against the intestines of the host, and usually bores forwards and slightly inwards, so that in comparatively small fishes the cephalon reaches the neighbourhood of the liver of the host. It rests in a pouch of membrane formed by reaction of the injured tissues, and, normally, the only opening in this pouch is the slit through which the hinder parts of the parasite protrude. The membrane is usually whitish, but in two instances is closely dotted with black chromatophores; it is for the greater part thin and fragile, but the anterior end of the cul-de-sac—the "feeding area"—is subjected to laceration by the mandibles, maxillae, and anterior dactyli, and is rugose and thickened; the mouth parts are sometimes scarcely removed from the liver of the fish by more than the thickness of the feeding area of the enveloping membrane. The entrance slit is very much narrower than the width of the parasite (even when the last-named is of moderate size), and it is thus totally impossible for the established female to leave its host. In small fishes the parasite is jammed between the two halves of the shoulder girdle, a condition which doubtless causes the crustacean to assume a pyriform shape as it increases in size (fig. 19, *d*). In a specimen of one of our large species of leatherjacket (*Cantherines hippocrepis*) an *Ourozeuktes* has entered the body cavity close to the vent, and has bored almost directly upwards and inwards, so that its mouth parts have almost pierced the swim-bladder of the fish; this parasite is nearly symmetrical.

The curiously expanded posterior limbs evidently assist the parasite to maintain its position, these legs being firmly pressed outwards against the soft enclosing membrane; the dactyli of the anterior peraeopods are hooked into the walls of the cavity near the feeding area. The large curved exopods of the first pleopods are obviously modified for the purpose of holding open the aperture in the skin of the fish (pl. xxxvi.); these lateral branches, and the pleon, together form a sort of funnel in which the endopod of the first pleopods and the three lamellae of each of the other pleopods are protected. The maxillipeds of the ovigerous female are lamellar in character and, as in other members of the family, are no doubt utilised to promote a flow of water through the marsupium

for the aeration of the eggs and young; in all probability the lamellar expansions of the posterior pereiopods also assist respiration.

It sometimes happens that a fish shelters two large *Ourozeuktes*, one on each side; I have before me a specimen of *Cantherines granulatus*, 135 mm. in length, in such case (pls. xxxvi., xxxvii.). The parasite on the left side is 26 mm. in length and 16 mm. in width (fig. 19, *b*), and the entrance slit in the skin of the fish is 12 mm. in length. This example is decidedly interesting, for its young are in progress of leaving the maternal brood pouch; these juveniles are, on the average, 3 mm. in length and 1.2 mm. in width, being thus larger than the "pullus stadii primi" of Schioedte and Meinert. Many young still remain in the marsupium, some are clinging to the pleopods of the mother, and others have emerged and firmly attached themselves to the skin of the fish (pl. xxxvi.). The example on the right side is also of some interest (pl. xxxvii.). It appears that in its efforts to penetrate further forward into the body of its host this specimen has allowed the exopod of the first pleopod of the right side to slip inside the body cavity of the fish. This has resulted in the rupturing of the lower side of the membrane sac and also of the wall of the intestine, so that the crustacean is partly embedded in a mass of food material from the gut of the fish; the posterior legs of the right side are extended outwards and the dactyli are hooked into the gut, but the hind legs of the other side are directed backwards with the outer faces of the lamellae pressing against the undamaged side of the sac. The anterior end of the sac is as in normal cases. The dotted outline on the photograph shows the relative size and position of this individual, which is 28 mm. in length and 16 mm. in width; the entrance slit is only 8 mm. wide.

Leatherjackets infested with *Ourozeuktes* sometimes appear thin and ill-nourished, and their flesh is flabby. The intestines and the anus often become displaced, the last-named moving a little to one side of the mid-line of the venter (pl. xxxvi.). I have removed one or two living female *Ourozeuktes* from their hosts; the parasites were singularly helpless when free and were quite unable to swim; when placed in water they sank to the bottom and gropingly waved their limbs, but otherwise remained motionless. They proved remarkably tenacious of life and lived for a considerable period out of water.

ADDENDA TO PART I.

ARGATHONA SIMILIS, Richardson.

A male of this species recently received from Mr. Glauert, of the Western Australian Museum, differs from the two females previously examined, and from the type male, in having the eyes larger and less widely separated, the narrowest interocular space being equal to one-sixth of the total width of the cephalon. The flagellum of the second antennae reaches to the middle of the length of the fifth pereiopod segment. The palp of the maxillipeds is four-jointed. The male appendage of the second pleopods reaches to the level of the apex of the endopod. This example is 14 mm. in length and was taken from a nannygai (*Trachichthodes affinis*) caught by Mr. G. A. Goss at Fremantle, Western Australia.

Also, two gorged specimens, a male and female, were collected a short time ago by Mr. Stan. Howe at Port Willunga, South Australia; these are 17 mm. and 19 mm. in length, respectively, and were found clinging near the anus of a parrot fish (*Pseudolabrus*). During life they were whitish dorsally, spotted with brown. The eyes of both examples are widely separated and the palp of the maxillipeds is four-jointed. In the male the flagellum of the second antennae

reaches back to the apex of the last coxal plates; in the female it attains to the level of the hinder margin of the sixth peraeon segment. The male appendage of the second pleopods is as in the male from Western Australia.

AEGA CYCLOPS, Haswell.

Included in a batch of material just received from Mr. Melbourne Ward, of Sydney, is a small *Aega* which should evidently be referred to this species. This example, which is a male, agrees with Haswell's type in the form of the frontal lamina, antennae, peraeopods, maxillipeds, uropods, etc. The body, however, is slightly more slender, and the head is relatively smaller, with the eyes smaller and meeting for a much shorter distance (only three facets in contact); also, a lesser part of the first pleon segment is covered by the seventh peraeon segment, so that the last coxal plates reach only to the hinder angles of that pleon segment.

The flagellum of the first antennae consists of seven articles and a terminal style, that of the second pair of twelve articles and a style. The telsonic

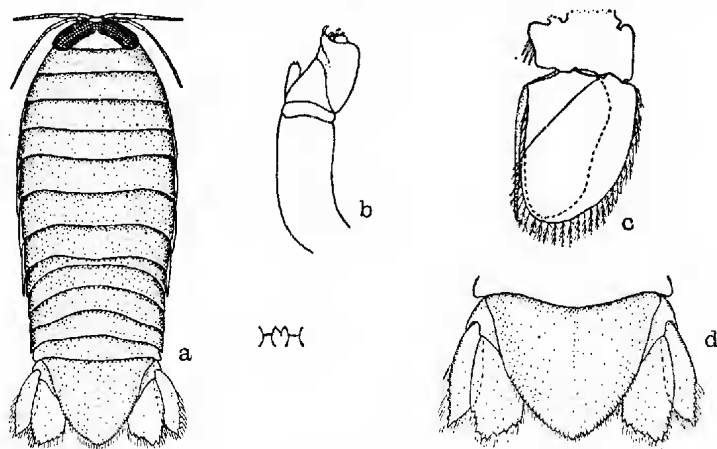


Fig. 20.

Aega cyclops, male: *a*, dorsal view ($5\frac{1}{2}$ diam.); *b*, maxilliped (38 diam.) *c*, second pleopod (15 diam.); *d*, telsonic segment and uropods (9 diam.).

segment is roundly subtriangular in shape, with the posterior half of the lateral margins finely serrate.

Length, 10 mm.

Loc.—New South Wales: South-east of Sydney, in "New Zealand area," 75 faths. (M. Ward).

As previously noted, the true shape of the telson cannot be ascertained from an examination of the type; *A. meinerti*, Miers, is apparently a closely allied species which has the telson apically truncate.

ROCINELA SILA, Hale.

A male dredged this year in Gulf St. Vincent closely resembles the holotype. The flagellum of the first antennae consists of five articles and a terminal style, that of the second antennae of eleven articles and a style. The male appendage of the second pleopods is nearly as long as the inner ramus. During life the colouration was as follows:—Cephalon margined with white, with a submarginal black line and with a white spot alongside intero-posterior angles

of eyes. Eyes black. Dorsum of peraeon and pleon with crowded brown reticulations (so that the ground colour appears pale brown); with a pair of closely approximated dark stripes on mid-line of cephalon, peraeon, and first five pleon segments. On each side of these median lines are two other longitudinal stripes, the inner of which extends from the anterior margin of peraeon to basal part of telson, and the outer occupies the whole length of peraeon. Underside subhyaline. Peraeopods and antennae subhyaline, marked with a few dark chromatophores; coxal plates and basal half of uropods orange; telson, uropods, and coxal plates marked with black as previously described.

Loc.—South Australia: five miles off Semaphore, 5 faths. (H. M. Hale).

DESCRIPTION OF PLATES XXXVI. AND XXXVII.

PLATE XXXVI.

Left side of a leatherjacket (*Cantherines granulatus*) showing adult female *Ourozeuktes* ensconced in the body cavity, and juveniles (which have recently vacated the brood-pouch of the crustacean) clinging to the skin. Note how the protruding exopods of the first pleopods of the parasite hold open the entrance slit in the skin of the fish. (3 diam.)

PLATE XXXVII.

Right side of the same fish (see pl. xxxvi.), which is burdened with a female *Ourozeuktes* in each side of the body cavity; the dotted line shows the relative size of the parasite. (3 diam.)
